Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

SEPTEMBER, 1959

CONTENTS:

Read and pass on—

Pickling Problems?

CLEPO powdered pickling compounds

reduce the hazard, corrosion, fume, spray, handling and storage problems of raw acid cleaners.

Here are some of the CLEPO compounds formulated to meet the exacting requirements of specific applications.

IF YOUR PROBLEM IS	USE
Pickling steel in tumbling barrels	CLEPO 191-D
Removing corrosive stains and corrosion products from wrought aluminum	CLEPO 192-A
Rapid removal of scale and rust from steel and iron	CLEPO 198-JA
Cathodic electro-pickling to remove smut or scale from steel	CLEPO 193-R
Removing rust and scale from cold rolled steel with little or no smut formation	CLEPO 193-B
Removing tarnish and scale from brass or copper before barrel burnishing, lacquering, etc., and providing brass with 24-hour salt spray resistance	CLEPO 181
Deoxidizing bare or clad aluminum prior to spot welding, heliarc welding, etc.	CLEPO 180-S
Stripping anodize coatings and whitening cast aluminum alloys without using hydrofluoric acid	CLEP-ETCH "A" SALT / used with nitric acid

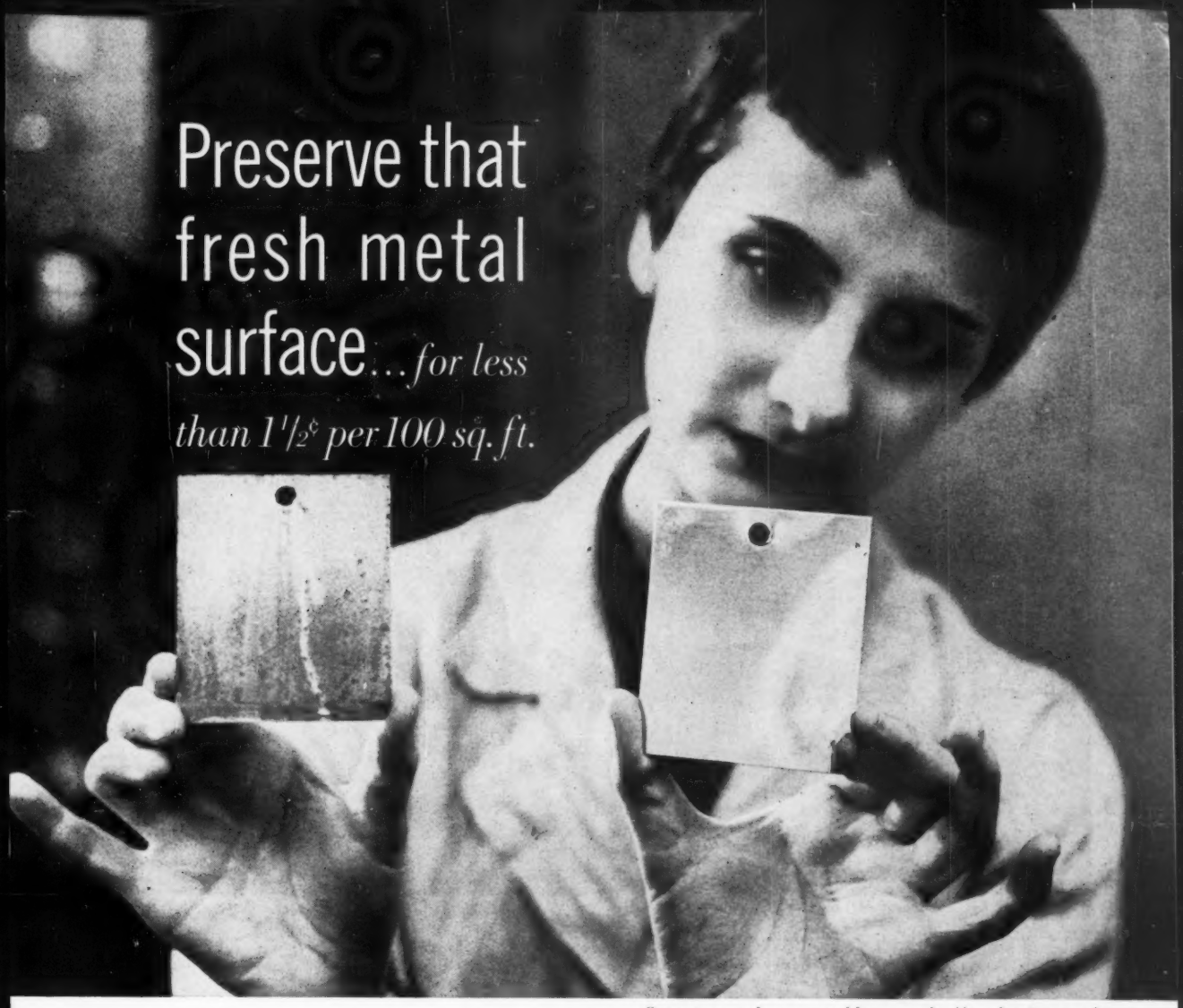
An experienced CLEPO metal finishing sales engineer works with you in each new application to insure top CLEPO performance.

Custom compounds for unusual requirements are developed in the Gumm research and testing laboratories.

Send for Bulletin 959

FREDERICK GUMM CHEMICAL COMPANY INC.
538 Forest Street, Kearny, N. J.

Preserve that fresh metal surface... *for less than 1½¢ per 100 sq. ft.*



Compare treated vs untreated brass panels. After cleaning, panel on right was rinsed in Entek 45 rinse; panel on left, in standard hot water rinse. Then panels were exposed to 100% humidity at 100° F. for 100 hours. Note how Entek 45 preserves "that fresh metal surface."

From Enthonics research come Enthone Enteks, a new series of rinse water additives which coat metal surfaces with an "invisible shield" against the atmosphere. Entek 45 assures faster drying, eliminates water spots and provides lasting corrosion protection to all metals. Entek CU-55 prevents tarnishing and spotting out of copper and brass even under tropical humidity conditions.

By adding Entek 45 to your final hot water rinse, you can prevent white salt corrosion of zinc and aluminum, prevent yellowing of nickel plate, prevent tarnishing of copper and brass, prevent black spots on cadmium plate.

By treating copper and brass goods or copper or brass plated items with Entek CU-55 you can prevent tarnishing, green salt formation, spotting-out and pit corrosion under high humidity storage conditions.

Entek protection lasts for months, yet costs less than 1½¢ per 100 sq. ft. to treat your parts, less than ½¢ per gallon to make up an Entek 45 solution!

Entek 45 produces an invisible, water-repellent organic film on the metal surface which sheds water rapidly and promotes stain-free drying. This same film acts as an invisible barrier between the metal and the moisture and oxygen in the air.

Entek CU-55 reacts with copper and copper alloys to form an invisible layer which has many times the corrosion resistance of bare copper and brass. Additionally, this layer has better solderability and improves adhesion of lacquers and enamels.

Write today for complete literature on both of these products to Enthone, Inc., 442 Elm Street, New Haven, Connecticut.

ASARCO

ANOTHER PRODUCT OF *Enthonics* RESEARCH

ENTHONE

A Subsidiary of American Smelting and Refining Company

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Before Buying Ultrasonic Cleaning Equipment

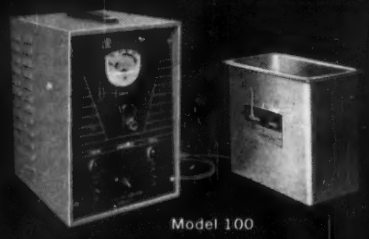
GET A FREE ULTRASONIC CLEANING ANALYSIS

To show you . . . at no cost . . . how ultrasonic cleaning equipment fits into your operation, National Ultrasonic Corporation now offers you a free ultrasonic cleaning analysis. An Applications Laboratory is maintained in which your sample parts are cleaned by specialists and returned within two weeks of their receipt together with the equipment and cleaning agent recommended for your particular application and their costs.

For your ultrasonic cleaning requirements, National Ultrasonic Corporation provides:

- Two lines of cleaners which cover the complete range of ultrasonic cleaning equipment through extremely high power units.
- NUclean® solvents and detergents, especially formulated for ultrasonic cleaning.

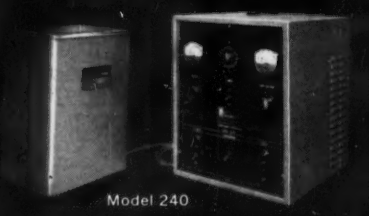
STANDARDLINE for all applications requiring average energy levels



Model 100

Model No. (115 volts A.C. 1 phase 60 cycle)	Capacity (gallons)	Power Output (watts) Average	Power Output (watts) Peak	Inside Tank Dimensions (in.) Length	Width	Depth	Crystal Radiating Surface (sq. in.)	% of bottom covered with crystals
100	1	60	240	9¼	5	6	12	25
120	2	125	500	10½	8½	6	24	27
140	7	250	1000	14¾	11¾	10	48	27.5
160	13	500	2000	20	16	10	96	30

HEAVYDUTYLINE for industrial applications requiring high energy density



Model 240

Model No. (115 volts A.C. 1 phase 60 cycle)	Capacity (gallons)	Power Output (watts) Average	Power Output (watts) Peak	Inside Tank Dimensions (in.) Length	Width	Depth	Crystal Radiating Surface (sq. in.)	% of bottom covered with crystals
200	1	60	240	7	4	7	12	43
220	2	125	500	9	6	10	24	44.5
240	5	250	1000	12	9	12	48	44.5
260	12	500	2000	16	12	16	96	50

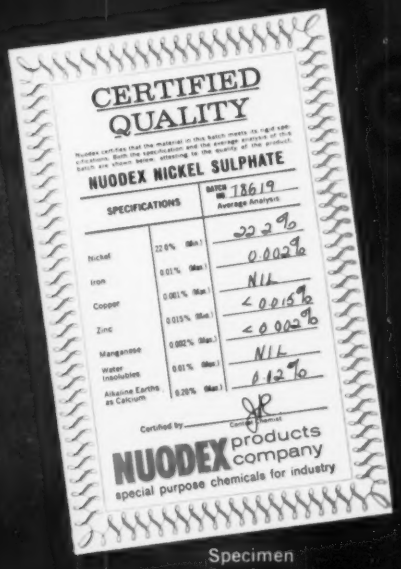
WRITE FOR COMPLETE INFORMATION

National Ultrasonic corp.

111 Montgomery Ave., Irvington 11, N. J.

ESsex 1-0550 • TWX NK 1030

The most important benefit in plating today


CERTIFIED QUALITY

Nuodex certifies that the material in this batch meets its rigid specifications. Both the specification and the average analysis of this batch are shown below, attesting to the quality of the product.

NUODEX NICKEL SULPHATE

SPECIFICATIONS		BATCH NO. 78619 Average Analysis
Nickel	22.6% (Min.)	22.2%
Iron	0.01% (Max.)	0.002%
Copper	0.001% (Max.)	NIL
Zinc	0.015% (Max.)	< 0.015%
Manganese	0.002% (Max.)	< 0.002%
Water Insolubles	0.01% (Max.)	NIL
Alkaline Earths as Calcium	0.20% (Max.)	0.12%

Certified by _____ Control Chemist

NUODEX products company
special purpose chemicals for industry

Specimen Certificate

Every package of Nuodex Nickel Plating Chemicals bears a signed certificate with complete specifications and exact analysis. There's no doubt about it. Only Nuodex gives you this assurance of consistent high quality and purity. Buy the best . . . it costs no more.

NICKEL SULPHATE • CHLORIDE • CARBONATE

Also available—**Nickel Acetate • Formate • Nitrate**

Sold exclusively through leading suppliers of plating chemicals. Write for the name and address of the one nearest you.

NUODEX special purpose chemicals for industry

NUODEX PRODUCTS COMPANY • ELIZABETH, NEW JERSEY

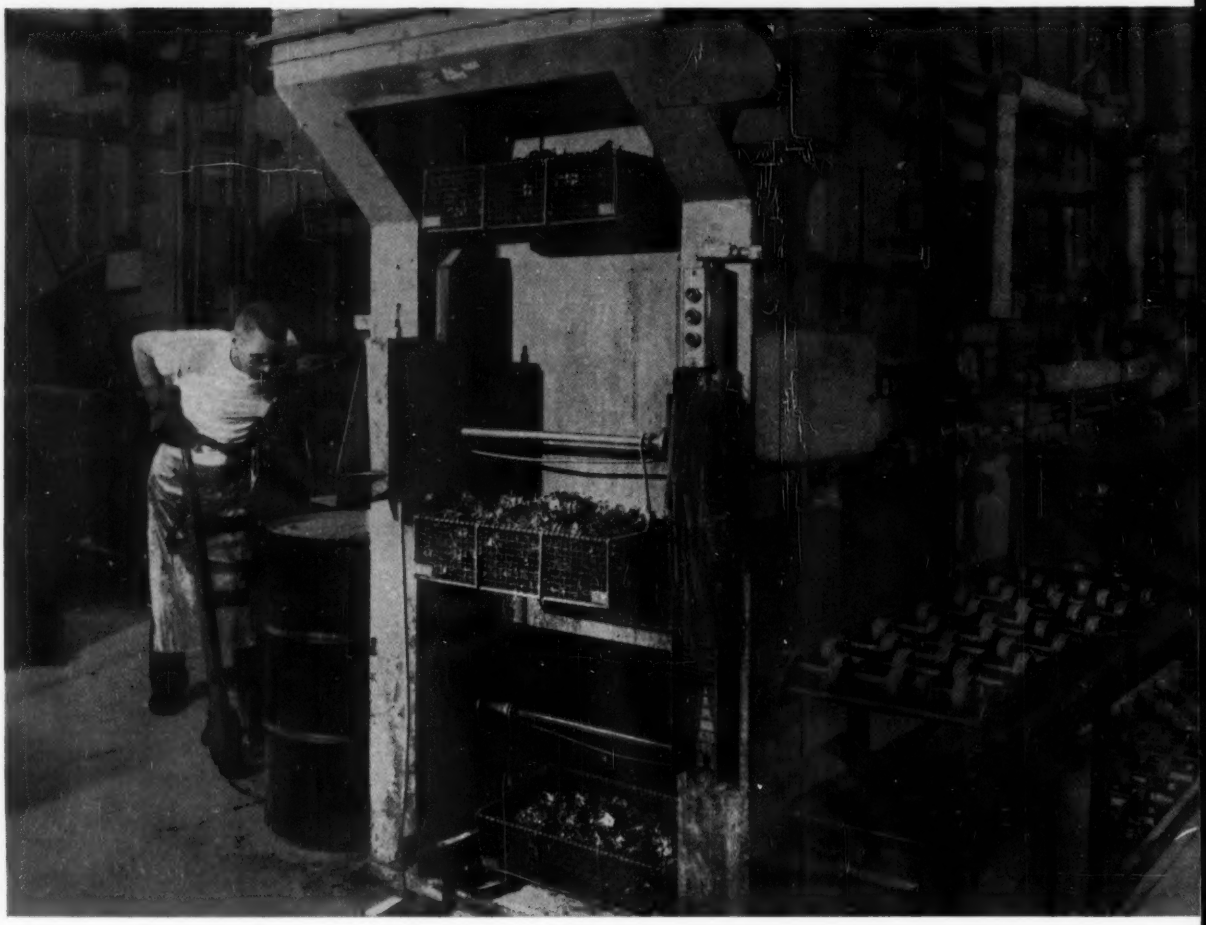
A Division of Heyden Newport Chemical Corporation

Fungicides • Nickel Salts • Organic Peroxides • Paint Additives • Stearates • Vinyl Additives

DOW

metal cleaning report no. 3

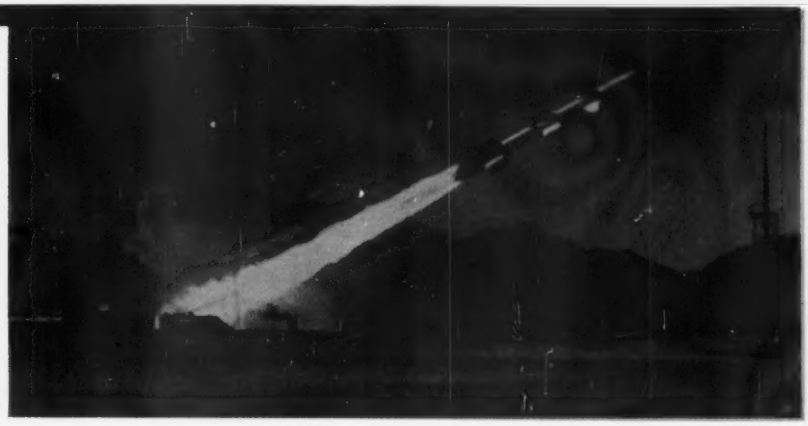
Suggested uses and case histories from your distributor of Dow solvents.



ELECTRONIC PARTS . . .

"CASE OF THE UNSEEN FILM" SOLVED

The difference between clean and not-quite-clean metal can mean the difference between high performance and no performance in electronic equipment. One maker of electronic components had a run of certain units which performed poorly. His distributor of Dow solvents helped trace the trouble down to invisible residue remaining on contact surfaces after degreasing operations. On the distributor's recommendation, the cleaning solvent was changed to NEU-TRI® (Dow's neutral stabilized grade of trichloroethylene). Troublesome residue vanished . . . so did the problem!

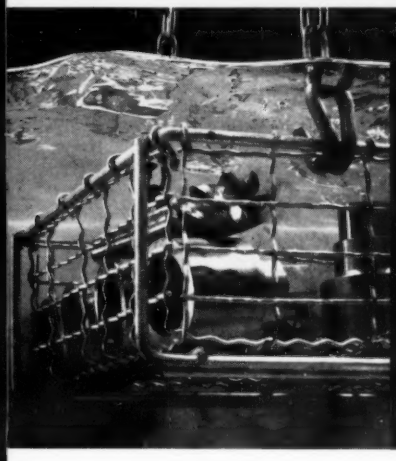


AUTOMOTIVE EQUIPMENT

New solvent adds clean profit—This manufacturer of automotive equipment was searching for ways to increase production and to cut per-unit costs. When he changed to NEU-TRI for vapor degreasing, he got completely cleaned parts faster . . . and more parts per hour off the line.

PRECISION BALLS AND BEARINGS

No place for "half-clean"—A producer of components for rockets, missiles and atomic piles depends on Chlorothene® to clean precision balls and bearings, using ultrasonic equipment. The solvent's major advantages in this case are greater safety and exceptional cleaning power.



FORGED PARTS

Resin's gone with the rinse—Removing stop-off resin from forged parts after plating operations can be a real problem! This tool manufacturer found it so before he standardized on fast-acting Dow methylene chloride, suggested by his distributor of Dow solvents. Now a quick dip, and a rinse in methylene chloride brings parts to assembly stage completely resin-free.

LIGHT GAUGE ALUMINUM

Large problem gets cold solution—Product too large for vapor degreasing? Then cold-dip it with Chlorothene (Dow 1,1,1-trichloroethane, inhibited). That's what this producer of aluminum storm doors, windows and screens did. And he found the high solvency of Chlorothene removed all contaminants thoroughly, permitting sound welds without pits or inclusions.

Double Value, Double Help—when you put Dow metal cleaning solvents to work in your plant. You get twin benefits because: (1) Dow offers the widest line of chlorinated solvents for modern industry (each designed for specific purposes); (2) your distributor of Dow solvents is ready, and fully qualified, to give you technical help when you need it. And he's backed by the knowledge and experience of Dow chemists and solvents specialists.

There's probably a spot in your operations that could benefit from the use of one of the many Dow industrial solvents. Or perhaps you've a problem in metal cleaning. In either case, your nearby distributor of Dow solvents is the man to call.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

FREE . . .
TECHNICAL SERVICE
on 24-hour-notice

Your distributor of Dow solvents will gladly help you with any problems you're experiencing with metal cleaning solvents. He'll have a trained solvents specialist en route to your plant within 24 hours after your call is received.

Ask your distributor of Dow solvents for details.

CHLOROTHENE®
TRICHLOROETHYLENE
PERCHLOROETHYLENE
METHYLENE CHLORIDE

See Your Distributor of Dow Solvents First!

NEW STANDARDIZED RECTIFIERS

BY H-VW-M

...Here's why they stole the show in Detroit!

Big hit of the AES Exposition: a new idea in rectifiers . . . made with standardized "building block" elements *custom-assembled to your special needs.* Standard parts eliminate costly trial-and-error, cut your costs way down.

ANODIZERS get the most precise controls available. This is the *only* line of rectifiers offering saturable core reactors and magnetic amplifier control as *standard equipment.*

BARREL PLATERS save money by buying simpler equipment . . . featuring low-cost half-control units made only by H-VW-M.

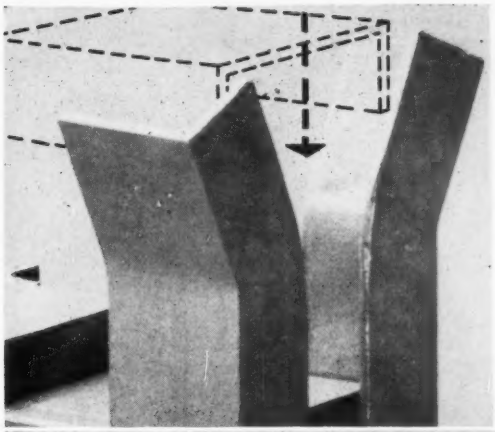
GENERAL PLATERS get the benefit of H-VW-M silicon diodes – all flush-mounted, and 250% bigger than most on the market, for cooler operation, longer life.

Find out more about new H-VW-M Rectifiers . . . the complete, *standardized* line that saves DC-power dollars! Write today to:

Hanson-Van Winkle-Munning Company, Matawan, New Jersey. Offices in principal cities.
Alert Supply Co. is H-VW-M in the west . . . Los Angeles . . . San Francisco.

H-VW-M

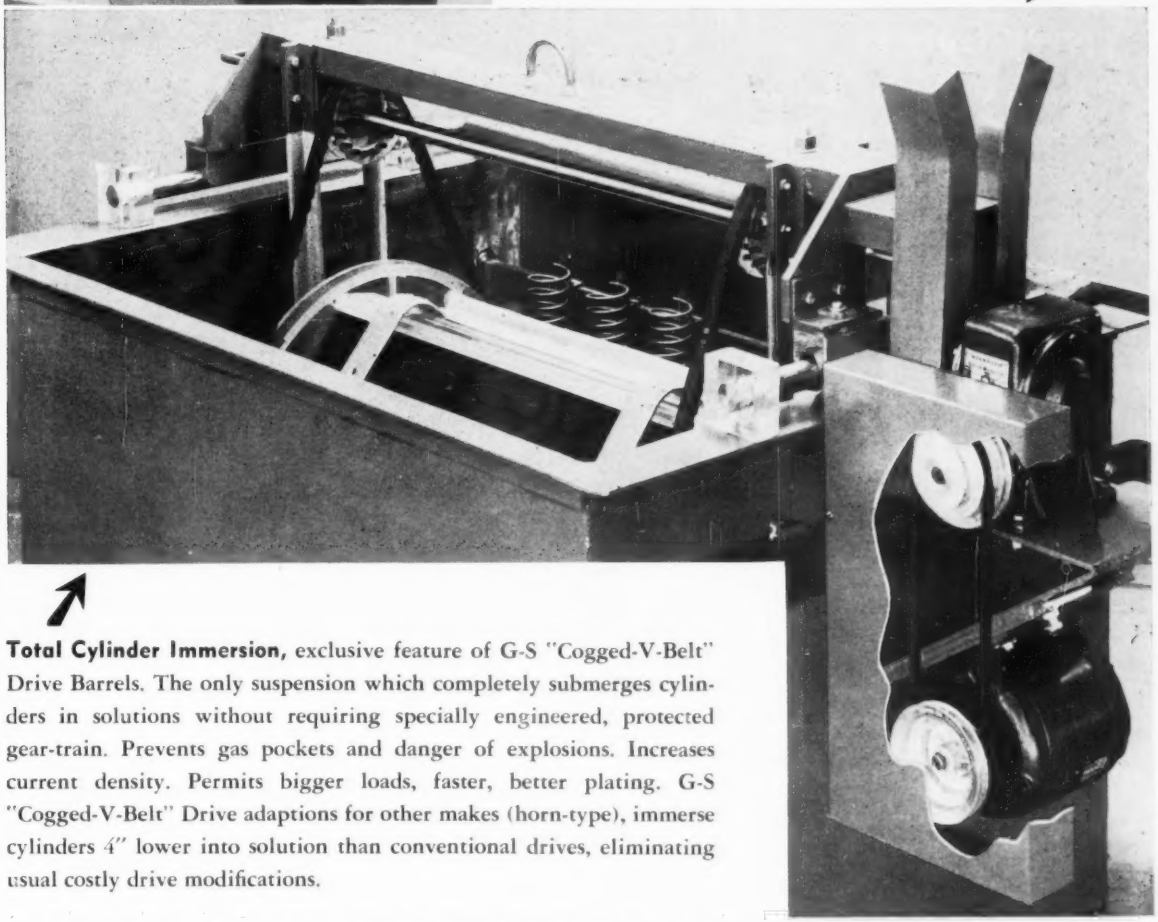
Progress in metalfinishing through advanced processes • equipment.



more special reasons why . . .

G-S means Greater Savings

Automatic Positioning of G-S superstructure for faster, more positive seating of contacts and meshing of drive gears without time-loss. When operator lowers superstructure, gear-guard "funnels" into flaring uprights of guide channel. Can't be untracked. Slides down into proper position automatically. Proof against carelessness, errors, etc., saves time, trouble.



Total Cylinder Immersion, exclusive feature of G-S "Cogged-V-Belt" Drive Barrels. The only suspension which completely submerges cylinders in solutions without requiring specially engineered, protected gear-train. Prevents gas pockets and danger of explosions. Increases current density. Permits bigger loads, faster, better plating. G-S "Cogged-V-Belt" Drive adaptions for other makes (horn-type), immerse cylinders 4" lower into solution than conventional drives, eliminating usual costly drive modifications.

G-S Gives You The Exclusive Features You Need for Better, Faster Plating at Lower Cost

★ **G-S "Cogged-V-Belt" Drive and Drive Pulleys** (patented) "The belt-drive with the gear grip" eliminates gears and bearings in solution. No gear maintenance.

★ **Floating End Plates and Longer Inverted-V-Contacts** (patented) for constant contact, 30% greater current flow.

★ **Automatic Positioning** (see above).

★ **Adjustable Bearings** (patented) support drive shaft — maintain constant mesh with motor drives at all times.

★ **Single Screw Adjustable Motor Mount** (patented) on tank raises and lowers motor drive gear to mesh with superstructure gear.

★ **Floating Hubs with Locking U** (patented) for directing danglers downward. Easier, faster disassembly.

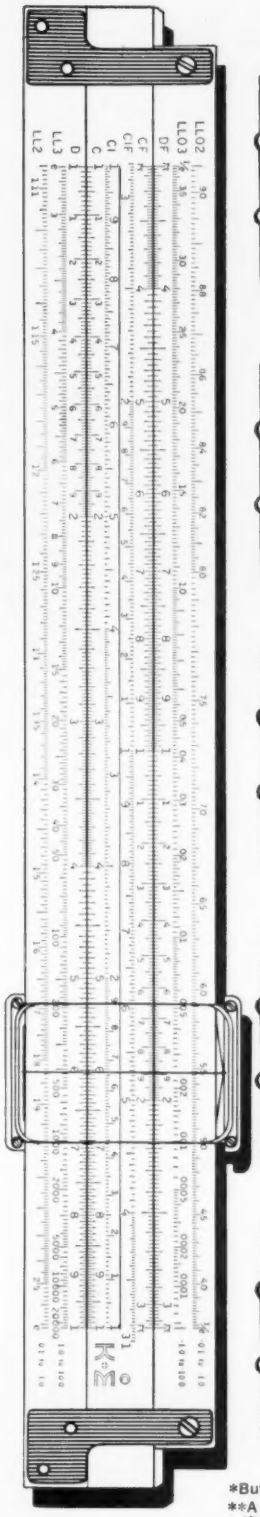
★ **Total Cylinder Immersion** (see above).

★ **Rugged G-S Bolted or Welded Cylinders** of "H-T Plexiglas", "Tempron", or Poly —any combination of components.

★ **Many more Features** — G-S outperforms all other plating barrels **at any price.** Horn-type contacts optional. Get the facts on G-S Conversion Plan for more plating profits. **Write today.**

The G. S. Equipment Co.

15583 Brookpark Rd., Cleveland 35, Ohio, CLearwater 2-4770



METHYLENE CHLORIDE
Boiling range—39.5-42.0°C.
Evaporation rate*—2750
Kauri-Butanol**—115
Flash point—None
Pounds per gal., 20°C.—11.07

CHLOROFORM
Boiling range—60.4-61.4°C.
Evaporation rate*—1160
Kauri-Butanol**—158
Flash Point—None
Pounds per gal., 20°C.—12.3

CARBON TETRACHLORIDE
Boiling range—76.0-77.0°C.
Evaporation rate*—1280
Kauri-Butanol**—92
Flash Point—None
Pounds per gal., 20°C.—13.22

MONO-CHLORO-BENZENE
Boiling range—131.2-132.2°C.
Evaporation rate*—75
Kauri-Butanol**—122
Flash point—84°F.
Pounds per gal., 20°C.—9.22

ORTHO-DICHLORO-BENZENE
Boiling range—176-182°C.
Evaporation rate*—15
Kauri-Butanol**—130
Flash point—174°F.
Pounds per gal., 20C.—10.84

*Butyl Acetate=100.
**A measure of solvent power—the mm. of solvent which can be added to 20 gms. of standard kauri resin solution at 25°C. before the solution turns hazy. Higher numbers usually indicate greater solvent power.

Does your present solvent measure up to these five from SOLVAY?

Compare the type you're now using with these Solvay® chlorinated solvents—and you may discover why the trend is towards these products. For many applications, they provide such important advantages as increased solvent power, reduced cost and greater safety. The chloromethanes are non-flammable and the chlorobenzenes have moderately high flash points.

Solvay—a leader in solvents research and development—makes available Technical Service to help you formulate paint removers and other solvent compounds. We offer literature, with comparative charts, to guide you in evaluating these Solvay solvents for your special needs. Mail the coupon!

Sodium Nitrite • Calcium Chloride • Chlorine • Caustic Soda • Caustic Potash
Potassium Carbonate • Sodium Bicarbonate • Chloroform • Methyl Chloride
Soda Ash • Vinyl Chloride • Ammonium Chloride • Methylene Chloride • Carbon
Tetrachloride • Snowflake® Crystals • Monochlorobenzene • Ortho-dichlorobenzene
Para-dichlorobenzene • Ammonium Bicarbonate • Hydrogen Peroxide • Aluminum
Chloride • Cleaning Compounds • Mutual® Chromium Chemicals

Allied Chemical

SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N. Y.

SOLVAY branch offices and dealers are located in major centers from coast to coast.

SOLVAY PROCESS DIVISION
ALLIED CHEMICAL CORPORATION
61 Broadway, New York 6, N. Y.

EG-99

Please send your solvents evaluation booklet (OC-5).

☐ See attached letter describing my solvents formulation problem.

Name_____

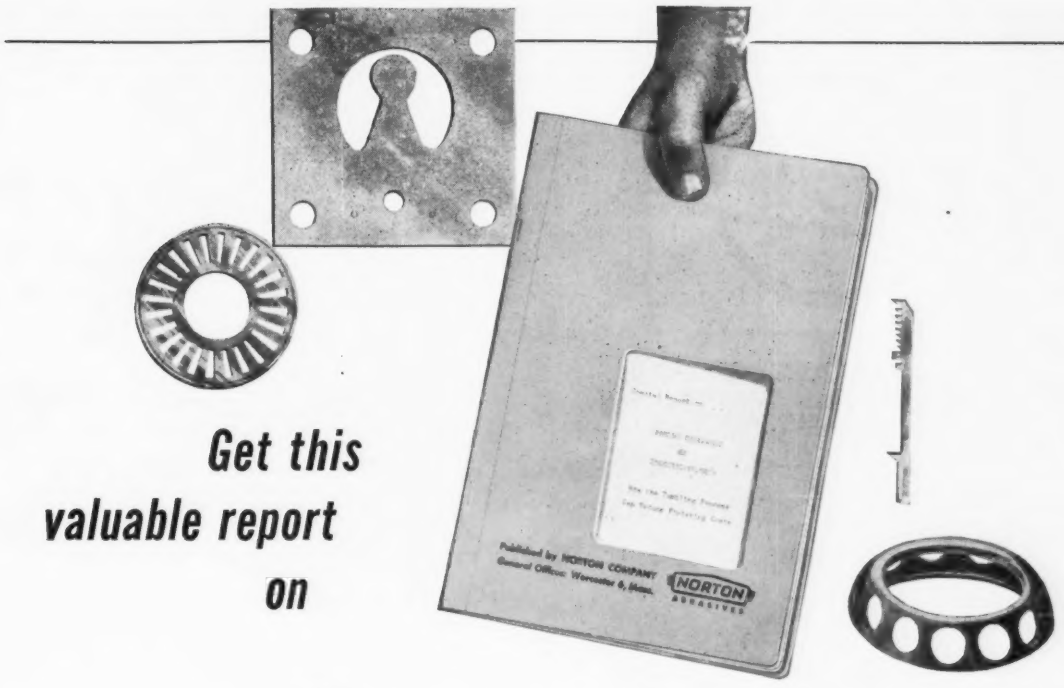
Position_____

Company_____

Phone_____

Address_____

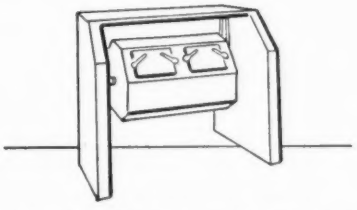
City_____ Zone____ State_____



Get this valuable report on

The best ways to finish metal stampings

from your Norton Representative



Newest in the Norton series of reports to industry is *Barrel-Finishing of Metal Stampings*, prepared by Norton engineers.

Based on continual observation of finishing techniques in many plants, this report brings you plenty of worthwhile information on the advantages of barrel-finishing equipment and abrasives. Included are facts on improving fatigue resistance of metal stampings . . . types and sizes of stampings you can barrel-finish . . . and reports like the following:

Cylindrical, steel-cage stampings had many slots with burrs on edge of each slot. Requirements were: removal of burrs, forming slight radii on all edges, improving surface finish. A large finishing barrel was charged with random-shaped ALUNDUM* TUMBLEX* *"A" abrasive chips in a water solution level with the top of the mass. All operations were completed in one run and thousands of parts were barrel-finished in one day.*

Aircraft panel stampings, 12" square x ⅛" thick, perforated, were processed by placing 12 panels 1" apart, using steel rods with fiber bushings as spacers. This whole unit was placed in the barrel, where bonded, triangular-shaped ALUNDUM TUMBLEX *"T" chips successfully removed all burrs from the stampings' edges and perforations.*

Your Norton Representative can supply you with this report fast — will also provide literature on all TUMBLEX abrasive types: "A" (random-shaped chips), "T" (bonded triangles), "S" (bonded spheres), and "N" (natural stones), covering the widest range of finishing requirements. And samples of your work parts sent to our Sample Processing Department will be promptly barrel-finished and returned to you with complete facts as to abrasives, methods and equipment. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world. G-371

*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

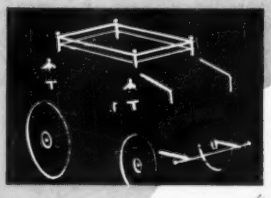
Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

HARSHAW

60 years

THROUGHOUT THE PAST 60 YEARS, THE HARSHAW RESEARCH LABORATORIES HAVE PROVIDED MANY DEVELOPMENTS AND IMPROVEMENTS WHICH HAVE SERVED TO PROMOTE THE GROWTH OF THE ELECTROPLATING INDUSTRY. INCLUDED AMONG THESE MANY ADVANCEMENTS ARE THE FOLLOWING OUTSTANDING EXAMPLES:



1927 Rolled depolarized nickel anodes.

1934 NIBRITE...The first commercial bright nickel electroplating process accepted by the automotive industry.

1935 ACID TIN ADDITION AGENT developed.

1936 XXX CAST CARBON ANODES...This special composition carbonized nickel anode was developed for use in bright nickel solutions.

1937 METAL FLUOBORATES used commercially for electroplating.

1945 PERFLOW...The first truly leveling, sulfur free nickel deposit.

1946 GRANULAR NICKEL SALTS...fine crystal free flowing single nickel salts of high purity.

1952 PERGLOW...Outstanding bright nickel with excellent leveling.

1953 PERFLOW-PERGLOW DUPLEX Nickel plate with unmatched corrosion resistance.

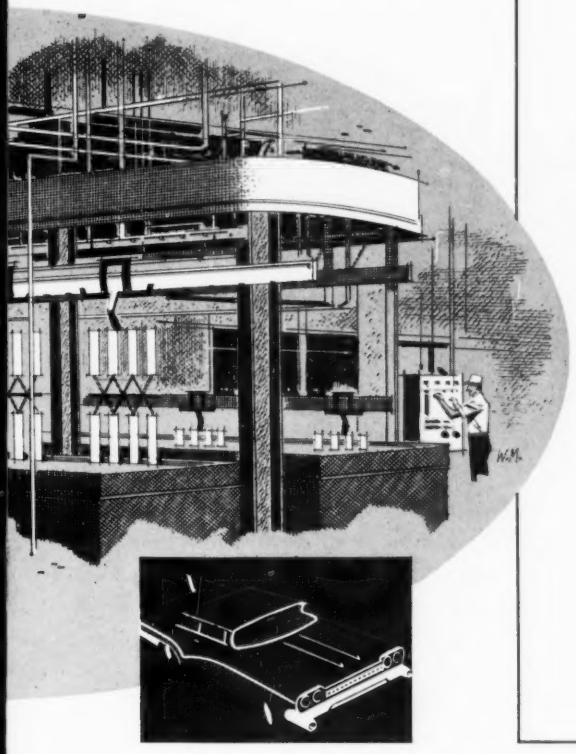
1955 AIR AGITATION...Adaptation for use in Harshaw nickel processes.

1958 CYNOREX COPPER...Exceptionally simplified bright cyanide copper process.

We will continue to offer platers complete service, including full programs of research and development in addition to complete plating processes, anodes, and chemicals

working for Platers

Nickel salts, nickel anodes, and cyanide of potash were Harshaw products produced for the Plating Industry as early as 1899. This modest beginning grew continuously to where our service to Platers includes full programs of research and development, many plating processes, and a complete line of chemicals and anodes. We will be happy to send further information on any of the items listed here—ask us for it.



HARSHAW PLATING PROCESSES:

Acid Tin
Tin Fluoborate
Lead Tin Alloy
Lead Fluoborate
Cadmium Fluoborate
Copper Fluoborate
Nickel Fluoborate
Cynorex Copper (High Speed Cyanide)
Cuprex Copper (Acid)
Perglow Bright Nickel
Nubrite Bright Nickel
Nubrite Bright Nickel (Air Agitated)
Airglow Bright Nickel
Modified XXX Bright Nickel
Perflow Semi-Bright Nickel
Perflow Semi-Bright Nickel (Air Agitated)
Perflow-Perglow Duplex Nickel
Lead — Tin Alloy Plating
Nibrite Barrel Nickel
Super Nibrite Barrel Nickel

CHEMICALS AND ANODES FOR MOST PLATING NEEDS:

Acid Tin Plating Addition Agent
Activated Carbon
Airglow Nickel Plating Addition Agents
Anocaps — Rubber Anode and Hook Protectors
Bags, Anode
Baskets, Anode
Boric Acid
Cadmium Ball Anodes
Cadmium Fluoborate
Cadmium Oxide
Cadmium Plating Addition Agent
Caustic Soda
Caustic Potash
Chromic Acid
Containers, Ball Anode
Copper Ball Anodes — Forged and Cast
Copper Cyanide
Copper Fluoborate
Cynorex Copper Plating Addition Agents
Cuprex Copper Plating Addition Agents
Filter Aid
Fluoboric Acid
Hydrofluoric Acid
Hydrofluosilicic Acid
Hooks, Anode
Lead and Lead Alloy Anodes
Lead Fluoborate
Lead Plating Addition Agents
Nibrite Barrel Nickel Plating Addition Agents
Nickel Acetate
Nickel Anodes — Rolled and Cast
Nickel Anodes — Toll Cast
Nickel Carbonate
Nickel Chloride
Nickel Formate
Nickel Fluoborate
Nickel Salts, Single
Nubrite Nickel Plating Addition Agents
Perflow Nickel Plating Addition Agents
Perglow Nickel Plating Addition Agents
Potassium Cyanide
Potassium Stannate
Rochelle Salts
Silver Cyanide
Sodium Cyanide
Sodium Stannate
Super Nibrite Barrel Nickel Plating Addition Agents
Tin Aluminum Alloy Anodes
Tin Anodes — Ball and Cast
Tin Chloride
Tin Fluoborate
Tin Sulfate
XXX Bright Nickel Plating Addition Agents
Zinc Anodes — Ball, Basket Type and Cast

THE HARSHAW CHEMICAL COMPANY

1945 EAST 97th STREET · CLEVELAND 6, OHIO

Chicago 32, Illinois · Cincinnati 13, Ohio · Cleveland 6, Ohio · Detroit 28, Michigan
Hastings-On-Hudson 6, N.Y. · Houston 11, Texas
Los Angeles 22, Calif. · Philadelphia 48, Pa. · Pittsburgh 22, Pa.

Congratulations to
AES
on its 50th
ANNIVERSARY

LEA

ABRASIVE FINISHING METHODS

ALUMINUM and MAGNESIUM

AND THEIR ALLOYS

CASTINGS · FORMINGS · EXTRUSIONS · SPINNINGS · STAMPINGS

Aluminum and Magnesium and their alloys are soft metals with high coefficients of friction and a tendency to be cut away at the grain boundaries if overheated during an abrading operation. These characteristics limit the choice of finishing procedures to those providing sufficient lubrication and those requiring a minimum of pressure.

The objective, of course, is to use the least number of operations permitted by the hardness and original surface to arrive at the desired commercial finish. Recommendations are of necessity rather general, but it is hoped they will serve as a guide. We shall, of course, be glad to make specific recommendations on request after studying samples of work.

POLISHING...A peripheral speed of 5000 sfm is recommended for polishing Aluminum and Magnesium when glue is used to bond the abrasive to the set-up wheel. From 5000 to 7000 sfm would be satisfactory using GRIPMASTER or PLASTI-GLUE cement for bonding the abrasive to the set-up wheels. In either case, the use of bar LUBAR, Clean Grain LUBAR or LIQUALUBE, a liquid lubricant, is necessary to prevent the wheel from loading which slows down the rate of polishing and causes gouging of the surface. Polishing wheels may also be prepared using liquid abrasive-cement compositions, such as LEABRAMENT or PLASTI-BRADE. LEA COMPOUND is frequently used for polishing Aluminum and Magnesium castings with sewed buffs, canvas, felt or leather polishing wheels which have been sized or pre-coated first with bar AD-LEA-SIVE No. 3

The resultant fast-cutting flexible polishing head is top-dressed with LEAROK or LUBAR to produce a smooth metal surface free of adhering dry particles of metal. Such particles would be produced by dry abrasives without the lubrication referred to above and would result in discoloration upon subsequent treatment, such as anodizing.

INTERMEDIATE FLEXIBLE POLISHING...Small defects, flash, etc. are removed and the surface brought to a uniform finish, using a flexible polishing step with a LEA COMPOUND (such as Grade "N") on sewed buffs or loose muslin sections at 4000 to 5000 sfm.

SATIN FINISHING... This is a final finish produced at surface speeds of 3000 to 5000 feet per minute. Use LEA COMPOUND such as Grades "N", "C" or "B-31" on loose muslin buffs, ventilated or bias buffs, string or wick wheels, with or without LEAROK or LUBAR lubricant, according to the line effect desired.

MATTE FINISHING... This is also a final finish, frosted in appearance. Using Grade "C" LEA COMPOUND at 5000 sfm on ⅜" sewed buff wheels will develop the heat necessary to produce the sand blast or frosted type of finish.

BUTLER FINISHING...To produce this final finish showing no surface defects, we suggest Grade "A-1", "B-12" or "MH" LEA COMPOUND on loose muslin buffs at 3000 to 5000 sfm.

BRIGHT FINISHING (Bar Compositions)... For cutting down stampings or extrusions, use Grade 765 LEAROK, at 6000 to 7500 sfm; for coloring, follow this step with Grade 884 LEAROK at the same speed. Use loose muslin buffs for both operations. For cutting down castings, use Grade 406 LEAROK; for coloring, use Grade 309 LEAROK.

BRIGHT FINISHING (Liquid Compositions)... All operations at 6000 to 8000 sfm.

Castings & Extrusions

Heavy Cut—FH77J or UF47J Liquabrade
Cut & Color—TH52P or 4994 Liquabrade
Color—UH20A or UH20D Liquabrade
Buff—Sisal for Heavy Cut; Ventilated or Sewed for Cut and Color; Loose buff for coloring.

Stampings & Extrusions

Cut—TH52P or 4994
Color—UH20A or UH20D Liquabrade
Buffs—Ventilated or Sewed

MAGNESIUM ALLOYS

Finishing methods for magnesium and its alloys closely parallel those for aluminum except that certain magnesium alloys do not drag or tear making unnecessary as much lubrication as is usually required with aluminum. Refer to above for general procedure.

Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions. Manufacturers of Lea Compound and Learok . . . Industry's quality buffing and polishing compounds for over 30 years.

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Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road, Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Buxton, Derbyshire, England

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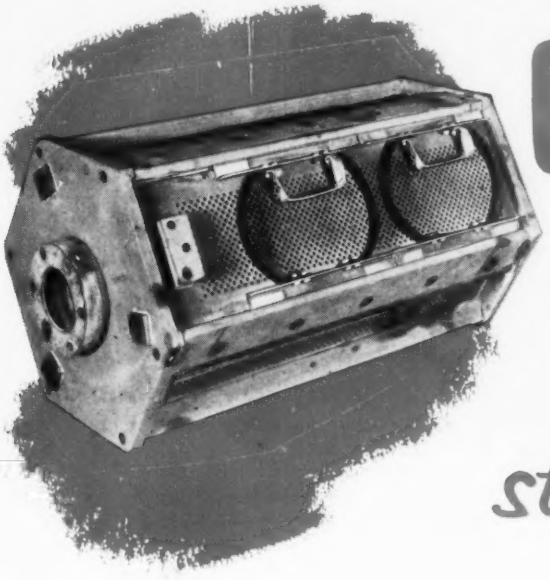
ABRASIVE FINISHING
ALUMINUM and MAGNESIUM
and their alloys

3,500,000 pounds of plating



processed by this UDYLITE TEMPRON cylinder . . . and it's *still going strong*

Al Betteley of Bellevue Plating says:

"We are thoroughly satisfied with Udylite TEMPRON Cylinders. The only reason that we haven't bought more of them for our present equipment is that we haven't worn out the original ones. You may be sure that we will specify Udylite TEMPRON cylinders on any new equipment of this type."

This TEMPRON Cylinder has handled more than three and one half million pounds of work without replacement or repair. This impressive performance was recorded at the Detroit plant of Bellevue Plating, a division of National Machine Products Co. There, 24 of these cylinders continue daily to deliver high economy, low maintenance production for the fifth straight year. They are operated regularly under extreme and abrupt temperature changes stubbornly resisting heat, cold, abrasion and chemical action.

In the experience of users everywhere, these rugged TEMPRON Cylinders, an original Udylite design, prove to be a best-possible buy. You, too, can achieve full production with an absolute minimum of shut-downs for maintenance by installing durable Udylite TEMPRON Cylinders in your plant. If you're not already enjoying the benefits of these perennially economic producers you owe it to yourself to investigate their money-making potential. Ask your Udylite man about TEMPRON cylinders or write . . .

the **udylite** corporation

detroit 11, michigan • world's largest plating supplier

A Timely Message on "The Quiet Revolution" by Ben P. Sax

Chairman of the Board, *American Buff Company*

Called by a Ford tool expert a "quiet revolution in the metal working trades", a new electrical oxidation development may be the stimulus to enormous new volume for its creators, as well as for the industry in general.

New electrical oxidation equipment now not only makes the machining of metals faster and cheaper, but will also enable American industry to develop and manufacture many new metal parts and products previously restricted by slow, costly die-making.

The new electrical discharge method uses a die shape formed in wood or plaster, then sprayed with soft metal. When hardened. the metal-coated form (used as an electrode), is placed near the die material, and electric current vaporizes even the hardest metal to the shape of the electrode pattern as easily as cast iron. This high-speed die production greatly shortens the time gap between design conception and production line.

This modern production "short-cut" promises to be a vital factor in cutting new model lead time for the auto makers (in some cases from two years to only six months). Also, it opens unlimited opportunities for many new, lower-cost products which are the staff of life for all of us in the metal-finishing trade.

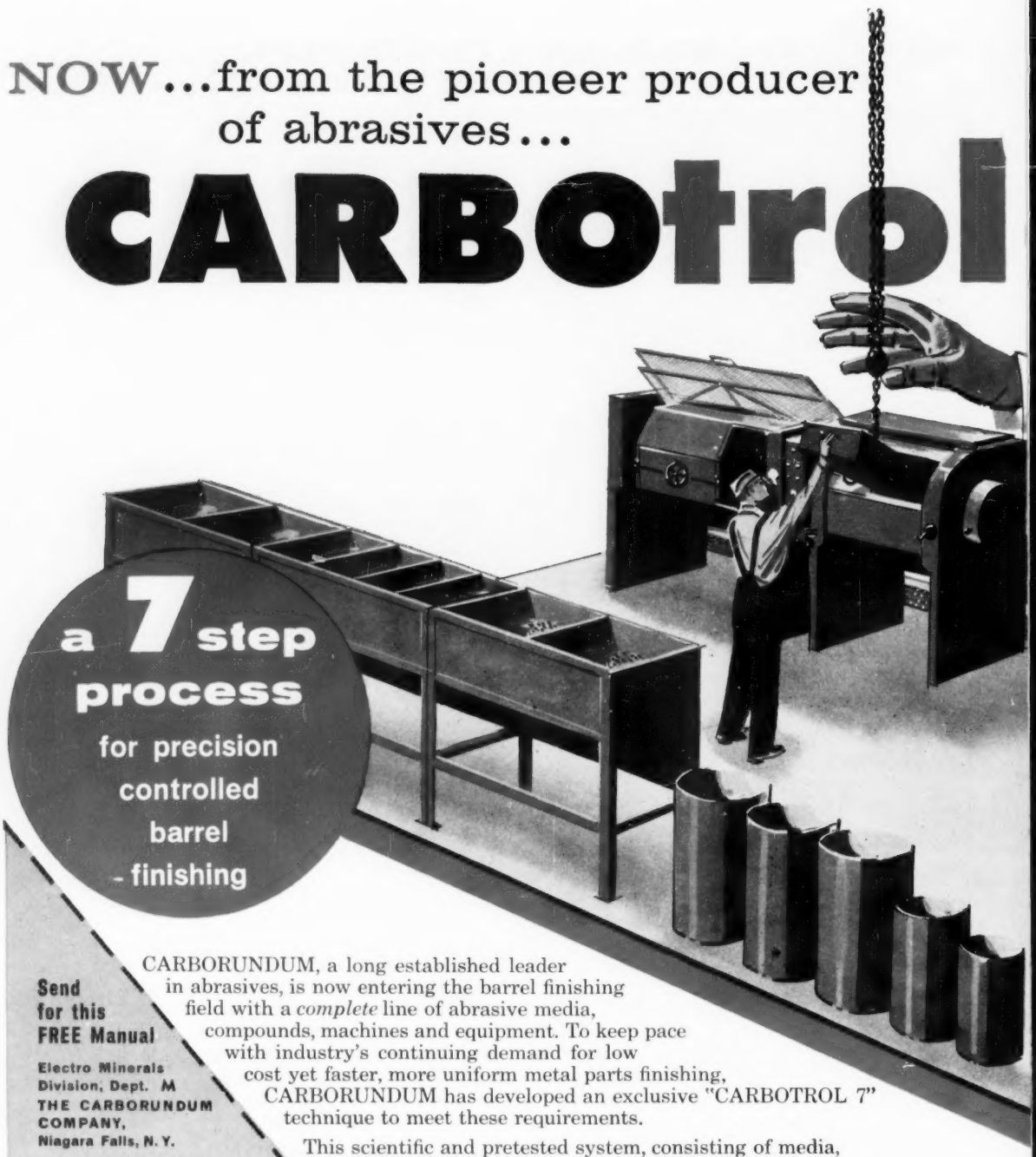
Sincerely,

Ben P. Sax

BEN P. SAX

NOW...from the pioneer producer of abrasives...

CARBOtrol



a 7 step process for precision controlled barrel finishing

CARBORUNDUM, a long established leader in abrasives, is now entering the barrel finishing field with a *complete* line of abrasive media, compounds, machines and equipment. To keep pace with industry's continuing demand for low cost yet faster, more uniform metal parts finishing, CARBORUNDUM has developed an exclusive "CARBOTROL 7" technique to meet these requirements.

This scientific and pretested system, consisting of media, compounds and machines, provides the right combination to fit practically any metal parts finishing problem today. The "CARBOTROL 7" components... made together to work together offer efficient and economical service.

Another CARBORUNDUM "First"... A staff of barrel finishing specialists and over 300 trained distributors strategically located from coast to coast offer you complete, prompt service. At CARBORUNDUM, service is as important as the product. Whether you require a recommendation on how to fully integrate barrel finishing into your present production or the solution to a single parts finishing problem, you are assured an *impartial* and *unbiased* solution from CARBORUNDUM.

LOOK INTO "CARBOTROL 7" TODAY

Send for this FREE Manual

Electro Minerals Division, Dept. M
THE CARBORUNDUM COMPANY,
Niagara Falls, N. Y.

Please send me your most advanced barrel finishing information contained in the 40-page manual entitled "CARBOTROL 7 System of Controlled Barrel Finishing."

Name _____

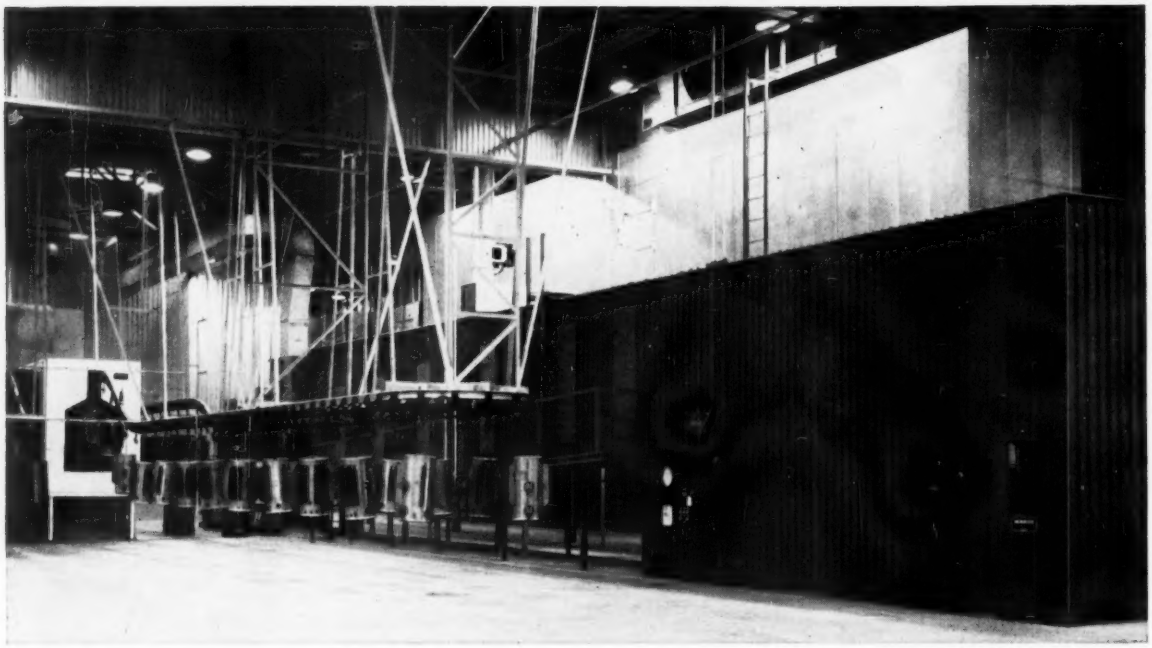
Title _____

Firm _____

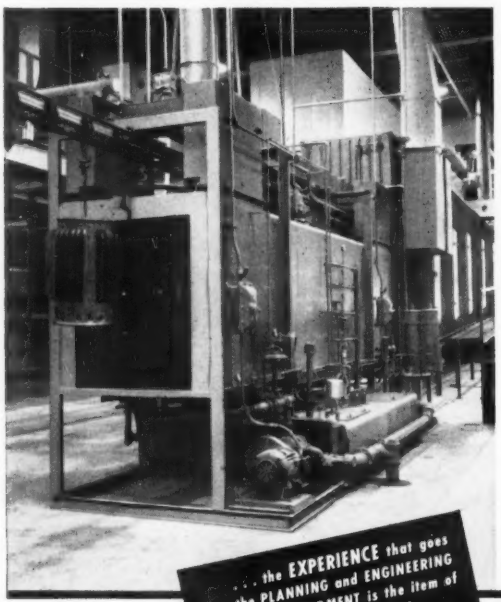
Street _____

City _____ Zone _____ State _____

FINISHING SYSTEMS...



Mahon Combined Flow Coating and Spray Painting Machines Paint Transformer Tanks Automatically at Westinghouse!



. . . the EXPERIENCE that goes into the PLANNING and ENGINEERING of MAHON EQUIPMENT is the item of GREATEST VALUE to YOU!

In a complete automatic Finishing System, recently installed by Mahon in the Westinghouse plant at Athens, Ga., transformer tanks with recessed bottoms are painted automatically, inside and outside, in an inverted position as they pass through specially designed, combined Flow Coating and Automatic Spray Painting Machines—tanks are rotated as they pass through the two simultaneous coating processes. Four coats of paint are applied and each is oven-baked on one continuous line that passes through Four Automatic Painting Machines—one is shown at left.

Other Mahon equipment in this Westinghouse plant includes a Transformer Coil Dehydrating Oven and a second Complete Mahon Finishing System for applying the final coat on completely assembled transformers.

If you are considering a new finishing system, or any unit of finishing or processing equipment, you will want to discuss methods, equipment requirements and possible production layouts with Mahon engineers . . . you'll find them better qualified to advise you, and better qualified to do the initial planning and engineering which plays such an important role in the ultimate operating efficiency of specially designed equipment of this type.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

Sales-Engineering Offices in Detroit, New York, Chicago and Los Angeles

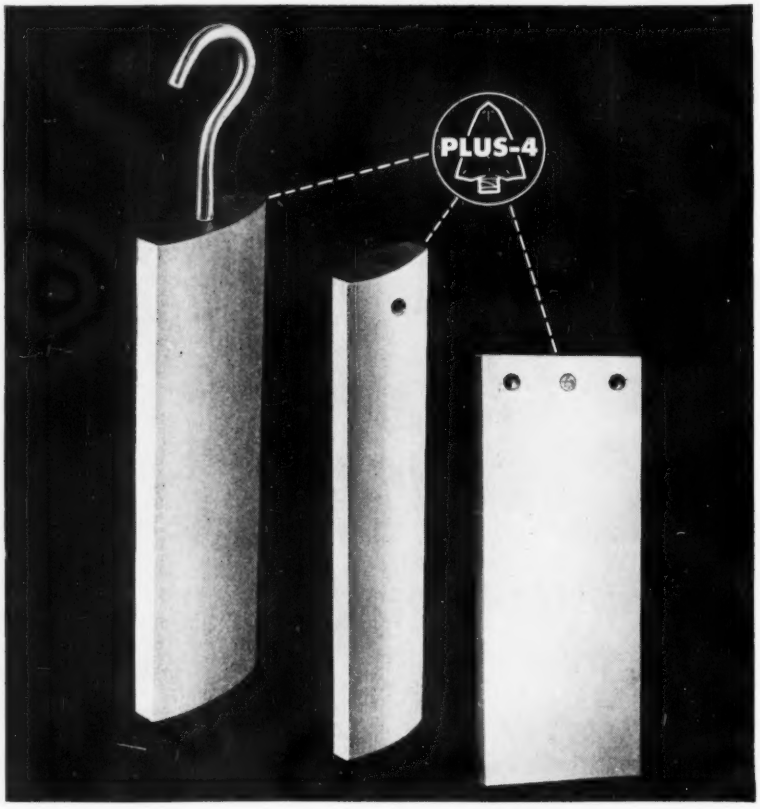
Engineers and Manufacturers of Complete Conveyorized Finishing Systems: Metal Parts Washers, Metal Cleaning and Rust Proofing Machines, Conveyorized Cleaning and Pickling Machines; Dry-Off Ovens, Spray Booths, Electrostatic Spray Enclosures, Flow Coaters, Dip Coaters, Finish Baking Ovens, and Paint Stripping Equipment; Core Ovens, Soldering Ovens, Dehydrating Ovens, Heat Treating and Quenching Equipment for Aluminum and Magnesium; Dust and Fume Control Installations, and Many Other Units of Special Plant and Production Processing Equipment.

See Sweet's Plant Engineering File for Information and Representative Installations, or Write for Catalogue A-659

MAHON

WHATEVER FORM OR SIZE YOU NEED

there are "Plus-4"® (Phosphorized Copper) Anodes to help you cut the costs of acid-copper electroplating—at the same price as ETP copper anodes



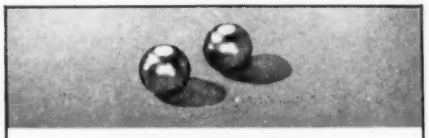
"Plus-4" Anodes in commercial use in practically all types of acid-copper electroplating have proved their advantages over wrought or cast electrolytic tough pitch copper anodes. The four advantages indicated by the name are:

+ 1 No anode sludge (no "bagging" or diaphragms required).
+ 2 No copper build-up in the solution.
+ 3 Smooth, heavy cathode deposits.
+ 4 Up to 15% more cathode deposit.

THE REASON for the elimination of sludge formation is that an anode of phosphorized copper develops an adherent dark brown film during electrolysis, which prevents the formation of free copper particles, but which in no way interferes with the plating operation or increases the electrical resistance of the bath. The phosphorized copper anode also corrodes more evenly, depositing more copper per pound on the cathode; gives a smooth, heavy deposit free from roughness due to lodgment of copper sludge particles; and leaves a small, compact "fish." There is no copper sludge or build-up of copper sulfate in the electrolyte.

WRITE FOR INFORMATION on how you can obtain a test quantity to supply one tank. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Toronto 14, Ontario.

59107



FORGED BALL ANODES

Anaconda ETP Copper Ball Anodes, used widely in cyanide plating, are cold forged from wrought metal. The result is a homogeneous, fine-grain structure, free from voids. Consequently they corrode very uniformly without disintegration. The balls are 2" diameter and weigh 1¼ pounds each. Identify them by the spearhead trademark.

ANACONDA®
"PLUS-4" ANODES
Phosphorized Copper
Made by The American Brass Company

MIRROR BRIGHT IN MINUTES with SEYMOUR HI-THRO Nickel Plate! Fast-acting HI-THRO saved precious minutes per beautiful product for the Jo-Lynn Company (Division of Brooklyn Plating Works) and produced the mirror-bright nickel that provides the base for the rich, durable polished brass finish you see above. Without a magnet, you'd never know this handsome, decorative tea wagon was made of steel.

If superb, long-lasting finishes figure in your sales and profits picture, insist on new Seymour Hi-Thro Bright Nickel Process! There's no substitute!

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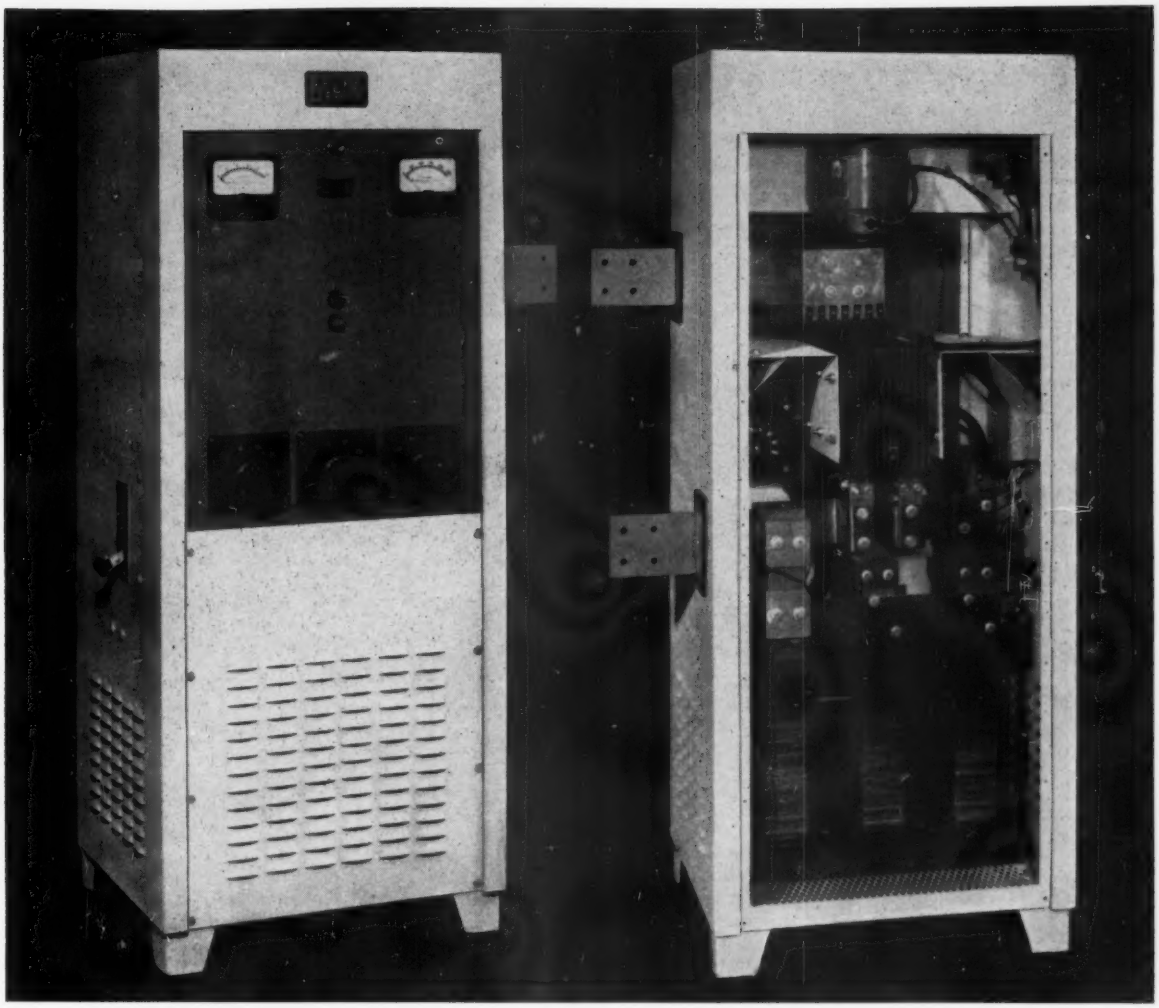
Send for Technical Brochure: Electro Chemical Supplies Division
THE SEYMOUR MANUFACTURING COMPANY, SEYMOUR, CONNECTICUT



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whatever your needs BELKE has the answer.

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So efficient much smaller plates give same output as plates of other Selenium Rectifiers and operate cool at full load with greatly reduced aging.

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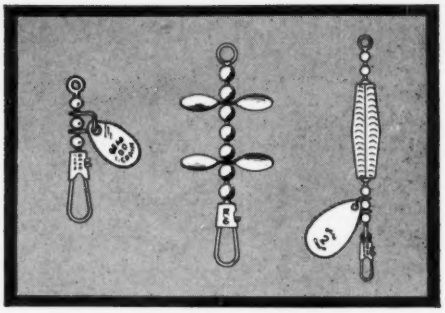

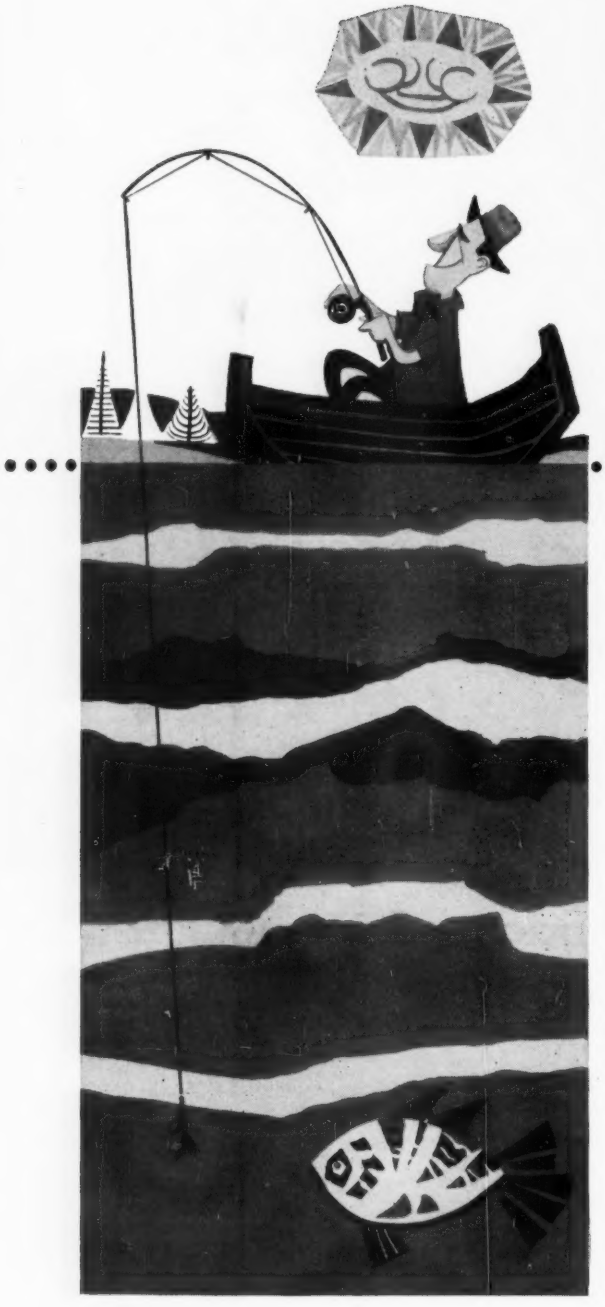

discriminating fish prefer **BEAD CHAIN** swiveling tackle

...it's finished with AHCO custom compounds

Every year more fish, in salt water and fresh, strike for Bead Chain spinners and lures. More happy fishermen land their catch with Bead Chain foolproof tackle. Appearance is mighty important to fish, so Bead Chain specifies Ahcoloid Cleaners, AHCO Barrel Brighteners, and AHCO Burnishing Compounds to produce the proper degree of deception. And the alluring finish lasts longer because each AHCO Compound is formulated to order.

Your product may not have to shine under water, but whatever its job a good finish—an AHCO finish—is its best salesman and its best protection. Let us show you what AHCO Compounds can do. Write, Apothecaries Hall Division, 28 Benedict Street, Waterbury, Connecticut.

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Only new

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LOW TEMP PHOSPHATING

gives you up to 200 mg/sq. ft. of zinc phosphate coating in 2 short minutes at 95° F.

The Turcoat low temperature phosphating process provides permanent paint adhesion when used at an economical, easy-to-maintain temperature of 95°F. This temperature is *lower* than that required by other "cold" phosphating processes. It is up to 75° *lower* than temperatures required by conventional phosphating processes. You save up to 75% in steam, water, electricity and downtime costs alone!

As a base for paint, the Turcoat low temp phosphating process provides a uniformly smooth coating of up to 200 mg/sq. ft. in two minutes at 95°F. **As a base for corrosion prevention,** it provides an 1100 mg/sq. ft. coating in just eight minutes at 95°F.

Turco has waited to announce low temperature phosphating until it was thoroughly perfected and proven, through exhaustive field testing, to be the very best. For this reason, you'll find that with this new process, just as with Turco's hundreds of other cleaning and chemical processes, you are assured of trouble-free operation, ease of control, and dedicated technical service... anytime, anywhere! Write today for the full story of Turcoat low temperature phosphating, along with Turco's phosphating reference chart. There's no cost . . . no obligation.

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FACTORIES: Newark, Chicago, Houston, Los Angeles, London, Rotterdam, Sydney, Mexico City, Paris, Hamburg, Montreal, Manila, Naha (Okinawa)

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Please send full details on Turco's new low temperature phosphating process and Turco's phosphating reference chart, without cost or obligation.

NAME_____ TITLE (OR DEPT.)_____

FIRM_____

ADDRESS_____

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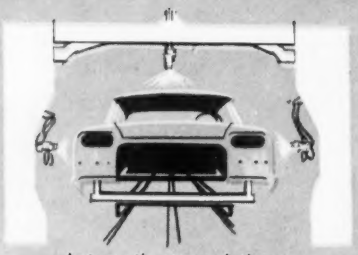
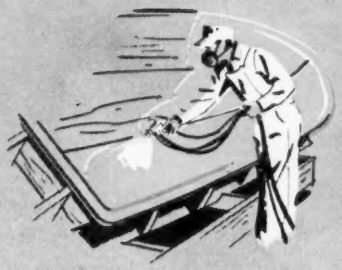
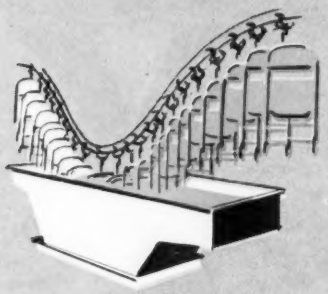


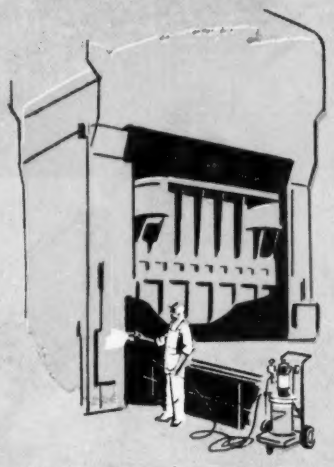
Automatic car painting



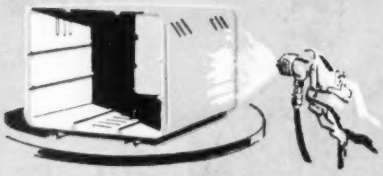
Fiberglass boat fabrication



High production coating of metal furniture



In-plant painting of bulky machinery



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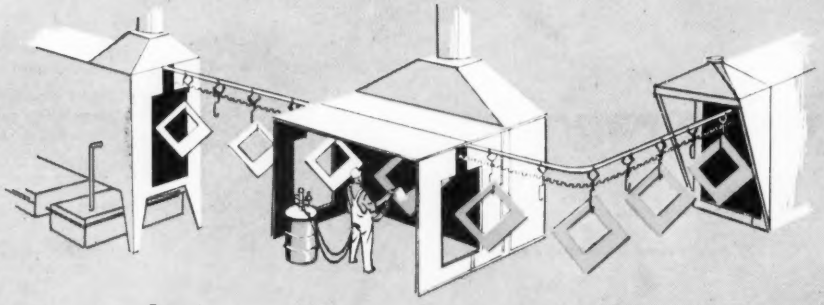
Spray insulation and corrosion protection

Fast, efficient plant maintenance painting



Complete systems for surface preparation, finishing, drying

FOR BETTER SERVICE, BUY

DEVILBISS

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Barrie, Ontario • London, England
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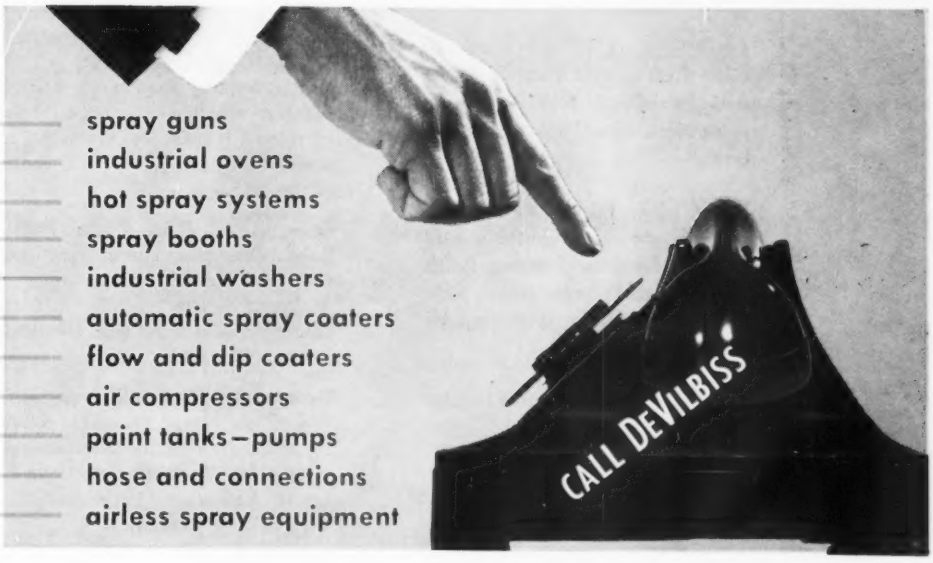
Branch Offices in Principal Cities

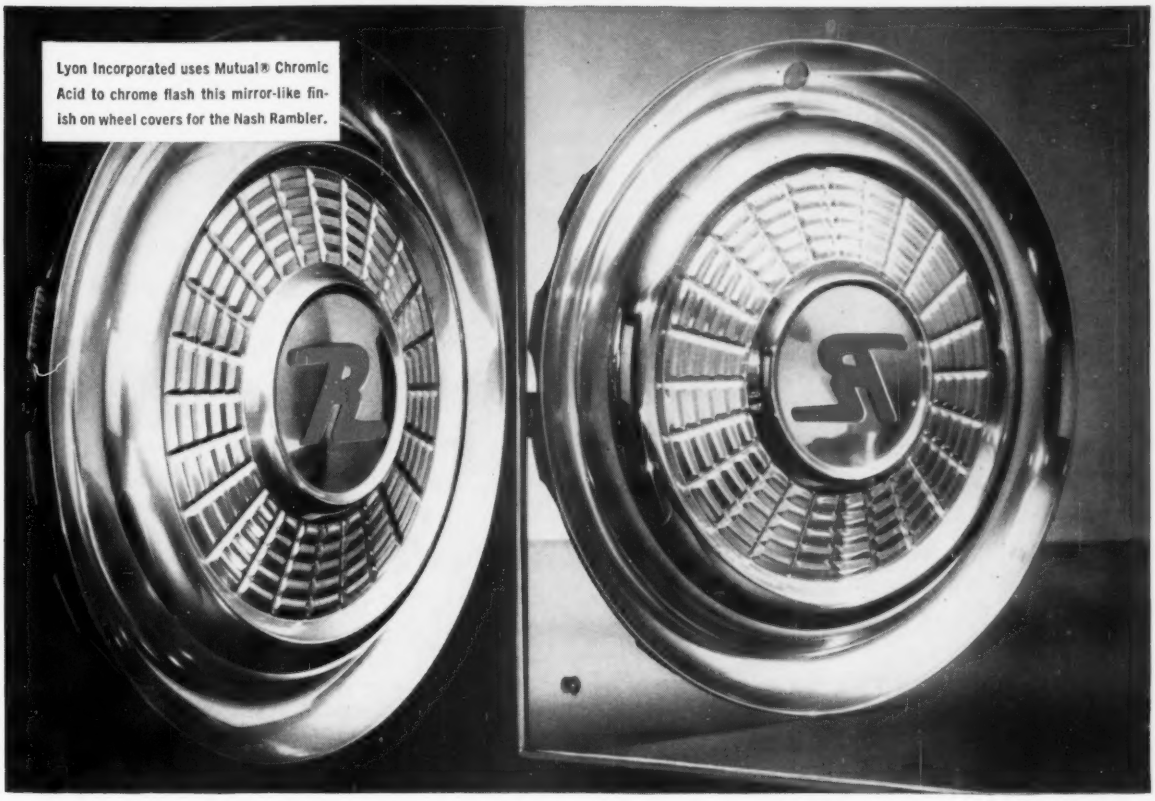
MANAGEMENT OBJECTIVE:

Determine best method and equipment for surface preparation and coating

ACTION: **Contact DeVilbiss**



HERE'S WHY: With the industry's most complete line of surface-preparation and coating and finishing equipment to draw on, DeVilbiss can supply you with matched components that complement one another to form a smooth-functioning system tailored to your requirements. DeVilbiss is the one "single source" fully qualified to analyze your needs, then let you select the best, most economical product combination to fit your job. Engineering and service facilities are available coast to coast. Just contact our nearest branch office, or write us direct.



Lyon Incorporated uses Mutual® Chromic Acid to chrome flash this mirror-like finish on wheel covers for the Nash Rambler.

MIRROR FINISH OVER STAINLESS!

Chrome flashed by skilled plater using MUTUAL CHROMIC ACID

Experienced platers, like Lyon Incorporated, rely on high purity Mutual Chromic Acid to produce chrome plate that's decorative and durable. Combining careful control and plating skill with Mutual Chromic Acid, Lyon produces a mirror-like finish on wheel covers for the Nash Rambler. The plating is done over 301 Stainless Steel in a bath of slightly lower acid-sulfate ratio than that used for chrome plating over nickel.

Mutual Chromic Acid is always 99.75% pure—or better. Its low sulfate content (less than 0.1%) makes it easy for you to control the acid-sulfate ratio of your plating bath. This safeguards against plating difficulties—and expensive rejects!

For technical information about Mutual Chromic Acid, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service Staff will also be happy to answer your questions.

OTHER PRODUCTS FOR PLATERS

SOLVAY® Ammonium Bicarbonate • SOLVAY Caustic Soda
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MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast.

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☐ Send Bulletin 52 "Chromium Chemicals"
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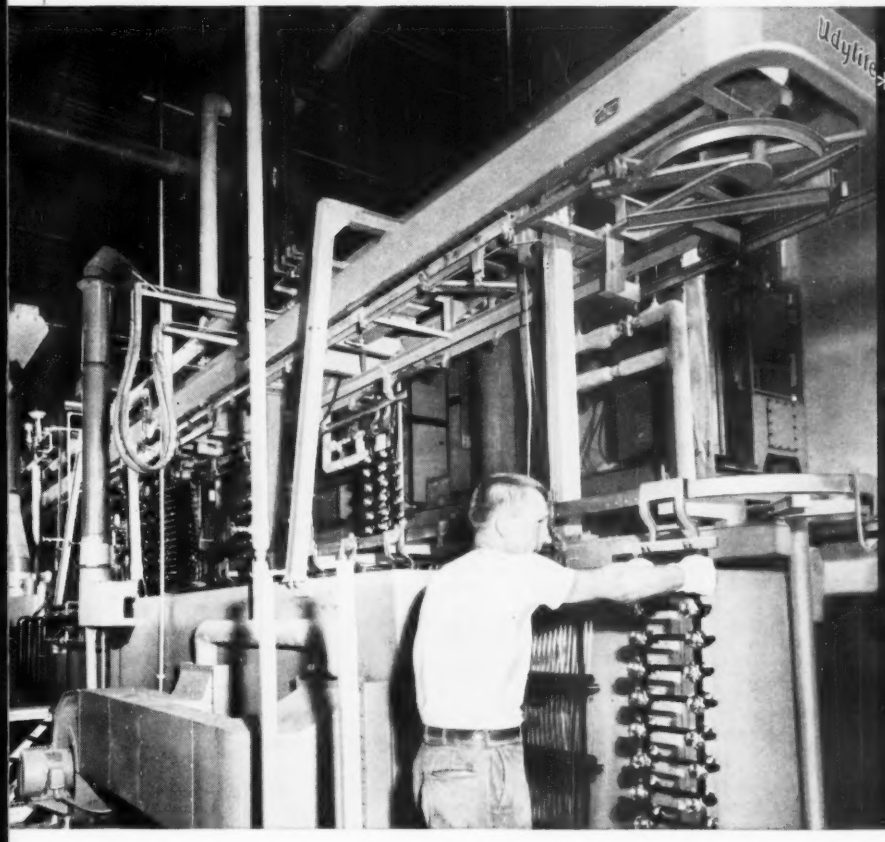
When our engineering design team goes to work on a problem it draws upon practical experience — yours and that of others in the industry added to our own well-tested knowledge. In our forward planning of new and better equipment to meet those problems we give full consideration to proven methods presently in use as an aid in directing our research. We then look for *a better way.*

The top minds of the electrical, engineering and chemical fields who form the team are constantly striving to provide you with speeded production, improved plating quality and, importantly, reduced labor and operating costs.

The result of their advanced thinking, of countless pilot machine models built, torn down and rebuilt, of exhaustive experimentation and testing is the finest, most efficient and carefully engineered plating equipment . . . designed by Udylite to produce top product and top profit for you.

ANSWERS INDUSTRY'S PROBLEMS

. . . meeting the demand for high productivity.



* American Standard Plumbing & Heating Division at Cincinnati installed a Udylite Cyclemaster full automatic for deposition of nickel and chromium on brass fixtures. Results: 1. quality control to meet their exacting top standards—2. production far beyond expectations—3. a savings of almost half the floor space previously used and—4. rejects are almost non-existent. Bonuses: Ultrasonic cleaning included in this Cyclemaster eliminated certain degreasing operations formerly needed to remove buffing compounds from threads. And, here Udylite Plastisol coatings applied to all exterior tank surfaces insure long life with minimum maintenance. *Again,* the Udylite Engineering team meets specific customer's problems with applied knowledge and experience.

FLEXIMATIC

IS THE ULTIMATE

IN LOW-COST PROCESSING CONVEYORS

It's the ultimate in low-cost flexibility because it can include Dial-A-Cycle, Select-A-Cycle, delayed set-down, advanced pick-up, vertical oscillation, automatic load-unload and other big-conveyor features. Each of these features can be added very quickly and easily.

The *Fleximatic* is a return type processing, electroplating or anodizing conveyor. The gross load for one carrier is forty pounds, work and rack. The rack size is a maximum of 18 inches in the direction of travel, 14 inches thick, and 36 inches long with a 9 inch hook. The machine requires a head room of 9 ft. 3 inches and floor space (width) 102 inches wide with 30 inch tanks. The length of the machine can vary to suit any particular application. The shipping dimensions of the machine are 8 ft. 2½ inches high by 7 ft. 6 inches wide. For short machines it will be possible to ship as one unit. The minimum immersion time of the *Fleximatic* is six seconds. You can see *Fleximatic* operating at Matawan. Hanson-Van Winkle-Munning Company, Matawan, New Jersey. Offices in principal cities.

Hanson-Van Winkle-Munning Company, Matawan, New Jersey. Offices in principal cities.
Alert Supply Co. is H-VW-M in the west . . . Los Angeles . . . San Francisco.

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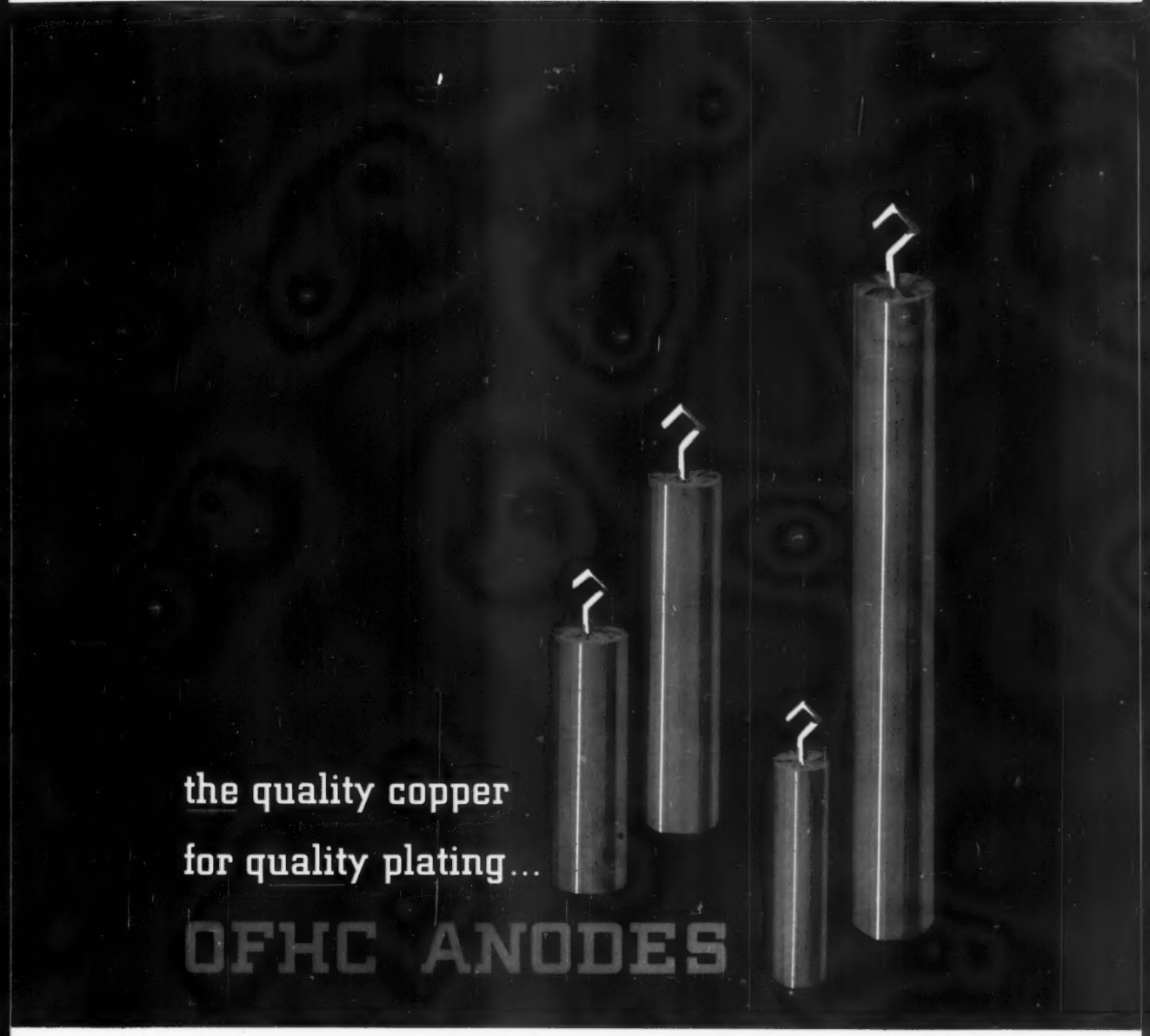

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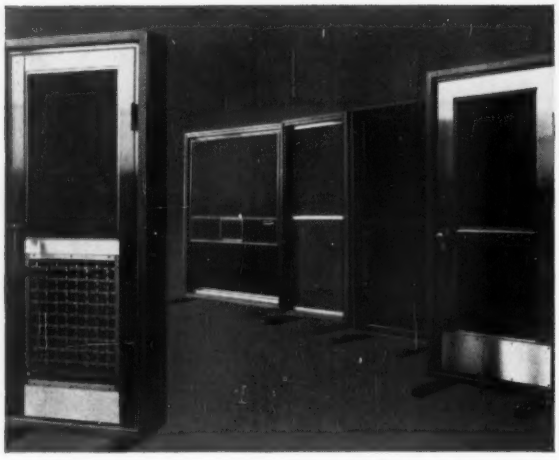
Columbia-Southern's Technical Service Department helped Kane cut their degreasing solvent needs by 30%

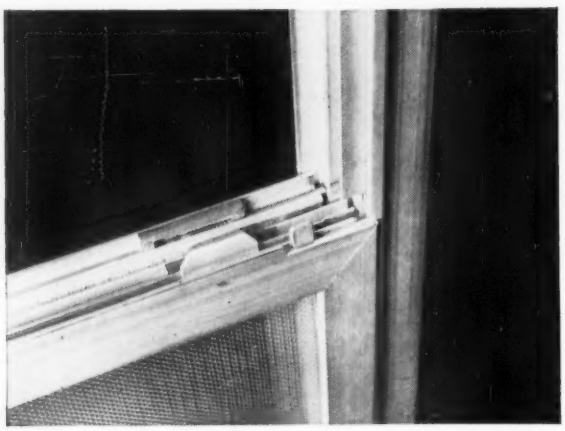


Every section of Kane's smartly designed, sturdy windows and doors has to be totally free of grease before painting or shipping.

Kane Manufacturing Company of Kane, Pennsylvania, is a medium sized custom builder of a wide variety of metal screens, door frames, and window frames. Their output has to meet the demanding specifications of highly experienced purchasers, since they equip many institutional buildings—hospitals, schools, government agencies. Many of their orders call for painted parts, and before painting Kane has to be sure that the metal surface is perfectly clean and free of foreign matter. These products are exposed to all sorts of weather, too, and that makes a good—and lasting—paint job even more essential. And most of them have intricate grooves and channels—ideal starting places for rust and corrosion. Also, many of their products are made of aluminum, a material requiring a high-performance solvent.

To make certain they were using their vapor degreasing operation most efficiently, the production people at Kane called in their Columbia-Southern Technical Service Representative. The Technical Service man, working with the Columbia-Southern distributor, Western Pennsylvania Chemical Company, reviewed Kane's set-up and then made specific suggestions. After putting these into practice, Kane found that their operation was improved to the extent that they could handle the same volume of degreasing work using 30% less solvent. The quality of the degreasing was better than ever, and working conditions were considerably improved.

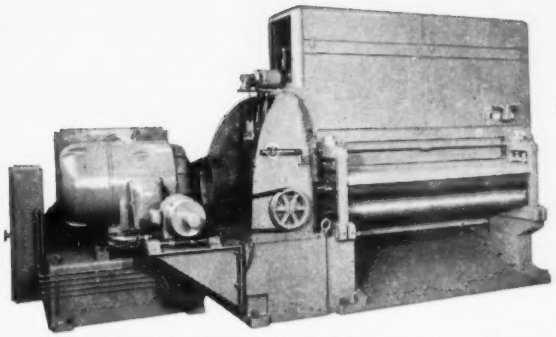
Kane found that vapor degreasing is the only efficient way to economically clean intricate, precision engineered channels and grooves—necessary features for snug-fitting but smooth-moving window panels.



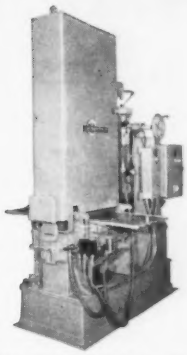
Workers in Kane's degreasing department like the thorough job Columbia-Southern Trichlor does in removing grease and other dirt. Once they have degreased a unit they can get on with the finishing operation in complete confidence. This enables them to set up smooth production cycles, without constant interruption for returning parts that are only partially degreased. And parts come out of the degreasing tank completely dry, so there's no need for a separate, time consuming drying operation. This thorough action means fewer man hours lost for cleaning out the degreasing tanks, too.

Lester Baum (right), Kane's Production Manager, discusses the improved degreasing operation with Ralph Reed, Sales Representative of Western Pennsylvania Chemical Company, who helped with the recommended changes.

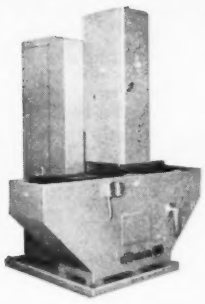
Vapor degreasing at Kane is a smooth flowing operation, and it's finished as soon as parts are lifted out of the tank, because they're completely dry, and ready for the next step.



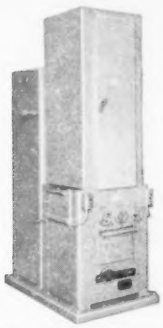
THIS MASSIVE SHEET POLISHING MILL is a pinch-roll type machine to be used for wider flat stock grinding and polishing with belt widths up to 74 inches. A few applications include: prepolishing of stock before forming; polishing stainless steel to standard finishes; upgrading finish of commercial rolled stock; and sizing of various types of sheet and coil stock to engineering tolerances.



THE MODEL FSP-20 MACHINE is a high production, pinch-roll type for polishing of sheet, coil or bar stock. Printed circuits are typical applications for this model. A series of narrow parts can be run side by side on the machine for increased production requirements.



THE MODEL KC-8 MACHINE is a conveyor belt type for high production of miscellaneous shaped parts having flat surfaces to be ground, polished or deburred. Typical applications include parts for tools, hardware, appliances and automobiles.



THE MODEL KP-8 MACHINE is a pinch-roll type for high production of sheets, coil or bar stock. Square or rectangular tubing and extrusions up to 4 in. thick are other common applications. The design of the machine provides a range from heavy stock removal down to fine finishing.

THE MODEL JC-6 MACHINE is a low-cost, high-production grinder and polisher. It is available either as a bench model with conveyor as shown, or the head can be used in conjunction with rotary tables. Multiple head assemblies can be mounted along one common conveyor belt.

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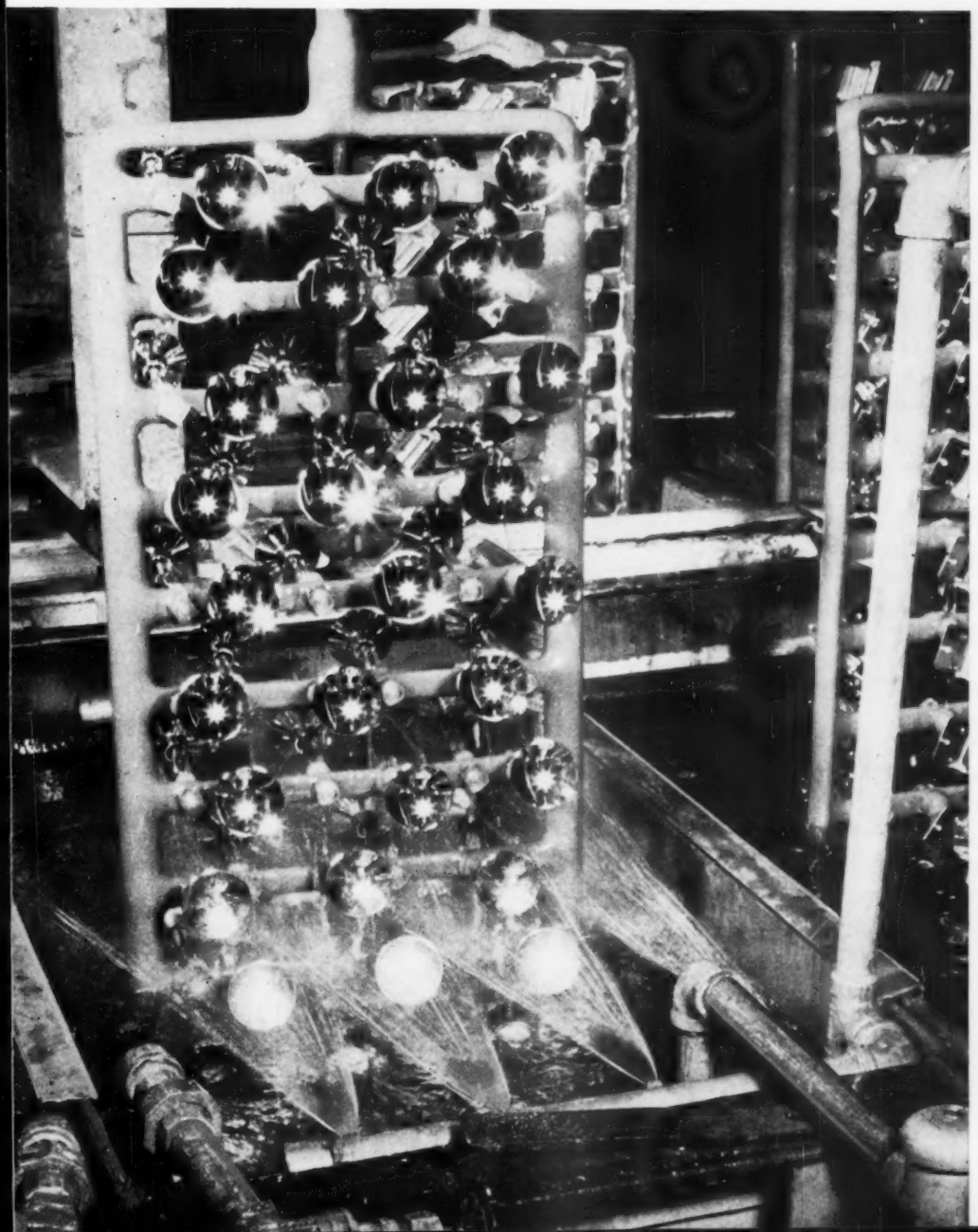

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Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

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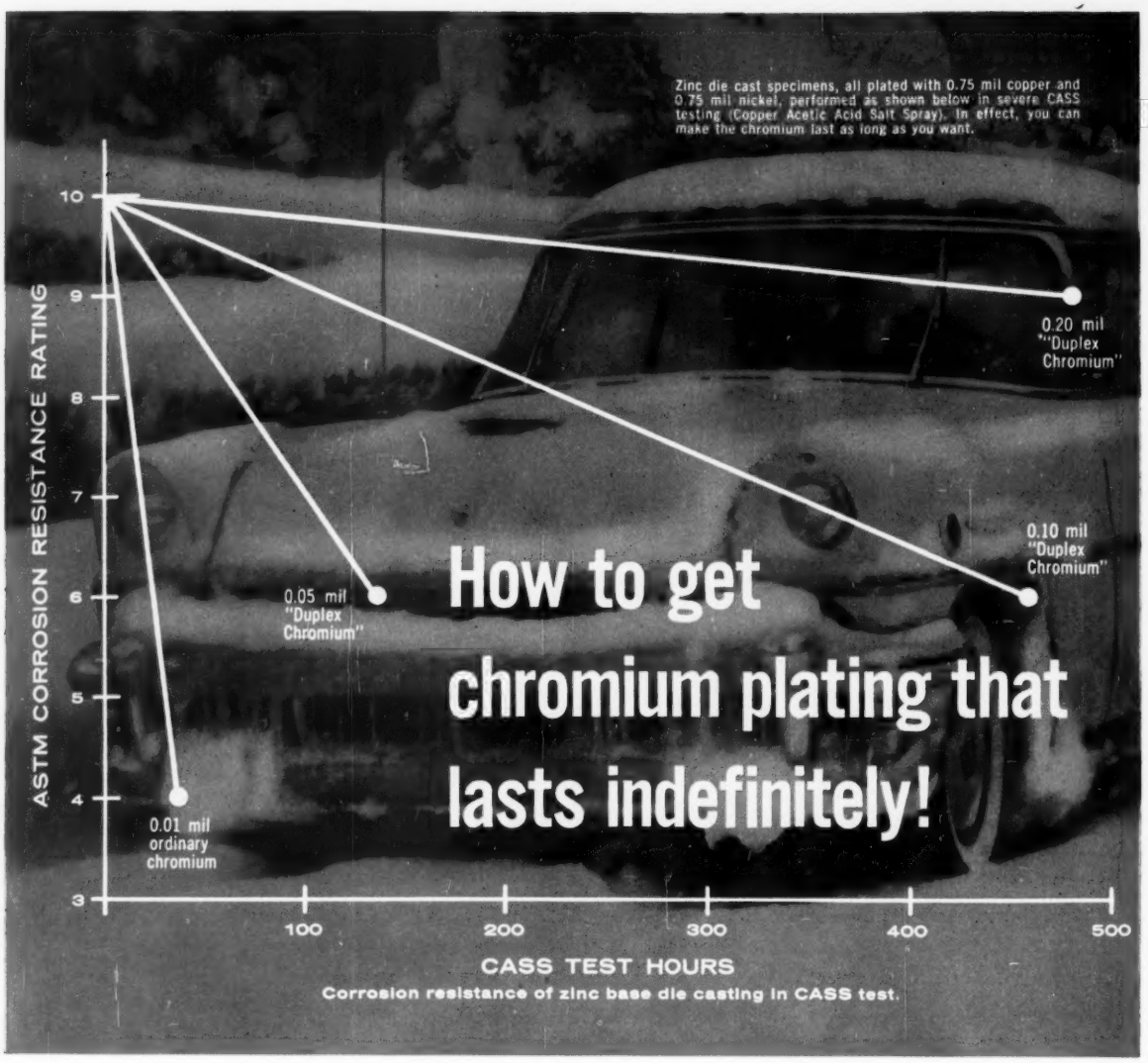

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Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
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ESTABLISHED 1903 VOLUME 57 • NUMBER 9 • SEPTEMBER, 1959

URBAN WASTE PROBLEMS

Situated, as we are, in the environs of Metropolitan New York, we have been in a good position to obtain a first-hand view of the problems confronting the plater located in a large city, as regards his wastes. Although we will be considering New York City, the same comments hold true for almost all others. In this area, traditionally from time immemorial, sanitary wastes along with industrial effluents have been conducted through the sewer systems into the surrounding tidal waterways, and the requirements of municipal authorities were met with little more than neutralization of acids to prevent corrosion of the lines. This practice has been quite prevalent along the eastern seaboard and, obviously, has contributed nothing to the enjoyment of aquatic sports.

With population growth, however, has come the need for more recreational facilities and also an awareness of a growing health hazard so that, to eliminate pollution, New York City has instituted a tremendous program of sewage treatment. Since it is no secret that cyanide, chromate, and metal salts in significant concentrations are not at all conducive to effective bacterial digestion of sanitary wastes, a law was also placed on the books setting the limits to the amount which could be introduced into the sewer system. Were the law to be enforced literally, we imagine all but a handful of plating departments would shut down, not because the law is unfair or exceptionally severe, which it isn't, but because meeting the requirements is a physical impossibility, under the circumstances.

Urban and rural operation do not present the same treatment and disposal problems. In the city, sanitary wastes are tremendous and, in consequence, the dilution effect permits acceptance of industrial waste at a higher concentration. In the small town, one large plating department could match in waste volume the outflow from all the homes tied into the sewerage system. On the other hand, since space in the city is at a premium, it is the exception rather than the rule for a manufacturer to arrange for more than the minimum. And, of course, his estimates did not include allowance for unnecessary waste treatment facilities.

Undoubtedly, some arrangement will be worked out, to avoid a mass exodus of industry. A possible solution would be for city sewage systems to accept rinse tank effluents which, if held to a minimum, would be diluted sufficiently with the sanitary wastes to be harmless to the sludge digestion process. Penalty charges on a sliding scale will be an inducement to the plater to reduce his outflow, which can be effected without much trouble by countercurrent rinsing and recirculation to other rinsing stations, where the water will serve a double purpose before draining to the sewer.

This would leave only the problem of concentrated plating solution discard and we have a suggestion for this also. They could be delivered by tank truck to a private or municipally-operated central treatment plant and a charge made, based on the volume trucked and handled, and the concentration of the chemicals to be destroyed. The cost would be far less to the plater than to operate his own facilities, and the matters of space and investment would be eliminated.

Nathaniel Hall

Fundamental Considerations In Polishing and Buffing

By Lester F. Spencer, *Technical Advisor, Nuclear & Centrifugal Pump Div., Allis Chalmers Mfg. Co., West Allis, Wisc.*

SELECTION of a finish is probably one of the most important economic and practical considerations that faces the manufacturer of consumer goods. He must consider and often reconcile conflicting merchandising demands and manufacturing limitations. In addition, problems such as shortage of materials, shifting markets, or changes in merchandising ideas may change either the finish or the method of finishing. In the selection of a finish, which may be divided conveniently into a lustrous, satin, mat, and scratch brush finish, the following comments may serve as a means of identification, thus:

(a) A highly lustrous finish, which is frequently associated with mirror and buffed bright surfaces, is particularly attractive; however, it is easily subject to fingermarks and scratches. To produce this type of finish it is necessary to follow an operational procedure that will remove all surface defects in the metal.

(b) A satin finish is usually more economical to produce since an attempt is made to blend into the finish proper any die marks, scratches, or other surface imperfections that may be on the polished surface. This finish may be divided into several categories, including dull satin, satin, regular satin, and bright satin finishes, the essential differences being that the finishing lines become lighter with accompanied increased underlying luster as the finish proceeds from a dull satin to a bright satin. Since it frequently eliminates one or more operational finishing steps, as compared to producing a lustrous finish, there is a wide field of usage.

(c) A mat finish, which may be either dull or bright, is produced by the use of an abrasive blast or acid dip, creating on the metal a frosted and non-reflecting surface completely free of parallel lines. On some metals, such as the aluminum alloys, a comparable finish may be realized by the elimination of lubrication during buffing at reasonable higher speeds.

(d) The scratch-brush finish frequently is obtained by the use of a brass or nickel-silver wire wheel revolving over a tray. A mixture of water and bran meal is applied liberally over the work being finished and over the wheel, producing a combination of coarse lines with a slight underlying luster.

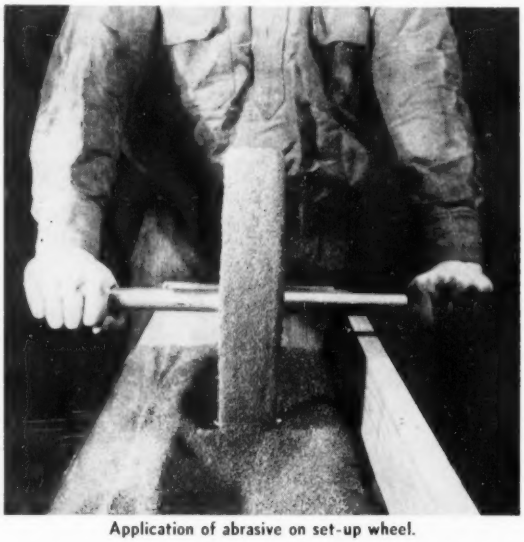
Serious consideration should be given to the design of the article so that all unnecessary projections, impressions, angles, and recesses are eliminated. Simplifying the design will simplify the finishing operation. In addition, it would eliminate the necessity of using narrow, small, or special types of wheels which usually lead to increased finishing costs.

Factors Affecting Surface Finish

One factor that will influence operational procedures is that of material being finished. It is well known that an inherently hard material such as steel will take a higher luster than a softer material such as aluminum. Thus, preliminary treatments that affect the hardness of a metal, such as heat treating, drawing, and rolling, have a marked bearing on the degree of luster that is produced.

Another determinant factor would be the ingredients of the polishing or buffing compound. This includes both the binder and abrasive employed, the latter usually being considered of more importance. This action obtained by a specific choice of abrasive binder is usually a function of the method of application to the wheel, the rate of drying, and the adhesion of the abrasive.

The influence of the type, size, and speed of wheel has been demonstrated in that as many as fourteen different finishes can be realized by holding



Application of abrasive on set-up wheel.

Photos courtesy Armco Steel Corp., Middletown, Ohio.

Polishing a large formed stainless shell.

constant the compound employed and varying both wheel type and wheel speed. These finishes ranged from striking highlights to dull satins. Among the wheels available would be included felt, walrus hide, special pocketed, sewed muslin, loose muslin, packed loose muslin, and string. With such a variety of wheel materials, it is not difficult to visualize the many different finishes that may be obtained by varying both the wheel type and speed.

Under any specific set of conditions of work material, polishing compound, wheel type and wheel speed, the pressure exerted in the polishing or buffing operation is largely determined through experimentation. There are no set values and, as a result, this very important factor must be determined largely by the experience of the operator. Too much pressure may cause overheating, dragging, or a too rapid cutting action. On the other hand, too light a pressure may not remove the imperfections on the surface of the material polished.

The Polishing Operation

To those that are engaged in metal finishing, the term polishing is applied to the abrading action that follows a grinding operation and precedes buffing. The amount of metal removed is usually less than that experienced in a grinding operation, and the number of polishing operations will vary in accordance with the original surface condition of the part. The factors of importance to be considered in polishing would include the wheel type, the adhesive and abrasive employed to coat the wheel, lubrication, and the wheel speed.

POLISHING WHEELS:

Polishing wheels are made from a variety of resilient materials among which are muslin, canvas, felt, and leather. The choice of polishing wheel may vary for any particular job, depending upon both the preference and experience within a shop. Thus, there are wheels available that are made of different materials, but have about the same flexibility and, therefore, can be used to polish the same type of work. On this basis, no hard or fast rule can be given in the selection of a polishing wheel. In general, the stiffer the wheel the faster it will cut and, although softer wheels have a reduced cutting rate, a finer finish is produced with the same grit.

Due to their versatility and relatively moderate cost, cotton fabric wheels are the most common for general all-around polishing. The hardest wheel of this type is made of individual discs of canvas cemented together, and has found its widest usage in rough polishing of brass, copper, aluminum, and non-ferrous castings. The softest wheel type is made of discs of muslin sewed together. Within this wide range, the popular wheel choice would be composed of sewed sections of muslin discs that are fastened with an adhesive. These wheels are frequently used on cast brass, aluminum die castings, and Monel metal. For reasons of economy these sewed sections are frequently made of balanced pieces of muslin rather than full discs of cloth.

Felt polishing wheels, since they are available in several density ranges from a rock-hard to extra-soft textures, are frequently used on iron, steel, and both brass and aluminum castings, as well as in dry-fining and grease-wheel operations on all types of work. The advantages obtained by the use of this type wheel would include, (a) the ability to be contoured to fit irregular-shaped work-pieces; (b) the ability to obtain a true facing on the wheel; and, (c) the realization of uniformity as to density over the entire surface of the wheel. A disadvantage is the higher initial cost, which usually restricts its use to the finer abrasive grit sizes and to the finer grades of work.

A tough and resilient wheel material with a springy open grain is either walrus or bull-neck leather, the solid wheel types being used for very high finishes in cutlery, holloware, tools, and brass goods. Leather-covered wood wheels, which are characterized by a minimum of flexibility, are preferred for flat surface polishing such as is encountered on door plates, name plates, cutlery, and on work with square or beveled edges. Wheels made of sheepskin discs have greater flexibility and less density. The harder wheel type, which is obtained by cementing the discs together to produce a more solid compact, is employed in the fine polishing of small work. The softer wheel type, in which the discs are sewed to maked the compact, is frequently used in finish-polishing operations on stainless steel sheet, brass, aluminum, and the soft alloys.

The compress wheel may be considered as a specialty design. These wheels have a rigid metal center or core onto which a flexible cushion made of canvas, leather, walrus, or felt is placed. The face width of a single wheel may range from 1 to 4 inches, whereas, the compound wheel design may have a face width from 5 to 10 inches. In both instances, the diameter will range from 8 to 24 inches. These wheels are reputed to be versatile, in that they handle practically every type of metal finishing from roughing to fine polishing operations. Other advantages would include the ability to contour the face of the wheel to fit the surface variations of the work, and the ability

to control the hardness or density of the cushion that contacts the work-piece.

POLISHING ABRASIVES:

The abrasives used in metal polishing would include aluminum oxide, silicon carbide, and Turkish emery. Of these materials, aluminum oxide is probably the most widely used; the essential characteristics being:

(a) a hardness that is rated fourth on the Moh's scale(capable of penetrating practically any commercial type of metal;
(b) excellent toughness with consequent resistance to wear; and,
(c) when crushed to the desired grain size, the material presents a desirable fracture pattern with sharp cutting edges, which present not only an excellent cutting surface but also permits excellent bonding to the adhesive used to coat the wheel.

Silicon carbide is also used to a considerable extent as a polishing abrasive. As compared to aluminum oxide, silicon carbide is harder, presents a more desired sharp and spindling fracture which provides rapid stock removal with minimum frictional heat, and is brittle, which limits its use to specialized operations. In the metal polishing field, silicon carbide is widely used on the soft and ductile metals such as pure aluminum, annealed brass and bronze, lead castings, and wide belt polishing of steel sheet. The lack of toughness of silicon carbide usually is not considered a disadvantage in the abovementioned applications, whereas, the increased sharpness of fractured surfaces will permit rapid cutting with a resultant better surface finish. Silicon carbide grains are usually more difficult to bond firmly to the wheel face as compared to aluminum oxide grains.

Turkish emery, which is a natural compound of aluminum oxide and one of the iron oxides, has the necessary hardness to penetrate most metals. However, its fracture is the poorest of all the abrasives employed, it being characteristically round and blocky with poor cutting edges and a total lack of concave sides for clearance. Due to the fact that the edges tend to wear smoothly without fracturing, although this property decreases the speed of cut, Turkish emery is used advantageously for fine polishing operations, particularly when used in conjunction with a suitable lubricant.

The choice of abrasive with respect to metal polished is extremely difficult. Thus, there may be a variety of alloys that may be grouped under one heading, with the result that the term used to identify such a group frequently does not give the desired lead for recommending the proper abrasive. As an example, the group identified as the "bronzes" may cover a wide variety of alloys ranging from a very hard, resistant alloy to one that is quite soft. Other examples that follow this same pattern are that class known as the "brasses" and the aluminum-base alloys, in which the inherent hardness is a function of the composition and, in some instances, depends upon the treatment given during processing. Thus, it is necessary to know in detail the alloy type as well as any treatment whch has been performed prior to finishing to select the proper abrasive. In general, the aluminum oxide abrasive is usually selected for the polishing of the harder materials, whereas, silicon carbide is used for the soft or "soft greasy" metals.

TABLE 1

Relationship of abrasive grit size to percentage of dry glue in sizing compounds

Grit Size	*Dry Glue, % by Wt.*
#30	50
#36	45
#46	40
#60	35
#80	33
#100	30
#150	25
#220	20

POLISHING ADHESIVES:

The most widely accepted adhesive for bonding the abrasive grains to the surface of the polishing wheel is hide glue. This material, which has characteristic toughness, resistance to impact, flexibility, and remarkably high adhesion for standard abrasive grains, should be selected on the basis of its jelly strength, melting point, viscosity, and flexibility. It should be free from excess bacteria since this factor decreases its jell strength.

Accepted practice dictates the preparation of a glue mixture that is sufficient for one day's use since this material has a tendency to pick up bacteria from the surrounding air. The decision as to the proportion of glue and water is made on the basis of strength of the dry glue and the size of the abrasive particles to be held, a guide for selection being given in Table 1. Ground glue is preferred since the soaking period, utilizing covered, sterilized containers, is not more than one hour. The soaked glue is then melted in a water jacketed glue pot, preferably made from copper or aluminum, at about 140 to 150°F. Overheating as well as prolonged heating, even at low temperatures, is considered inadvisable since glue strength decreases rather quickly.

When glue sizing is required, brushing the wheel face with the glue mixture, followed by thorough drying of the preliminary coat, is essential. New wheels should be sized on both the face and sides and, to prevent chilling of the glue, pre-heating the wheel and abrasive at about 120°F. is recommended. After the sizing coat has been dried, the coating for the first head is brushed on, after which it is rolled in a trough containing the proper abrasive. Air drying for about two hours follows. The second head, if required, is applied in the same manner. To minimize contamination of the wheel head with wild abrasive grains, an accepted practice is the use of separate brushes and glue pots for each abrasive size. The final drying of the wheel is conducted in a well ventilated room at about 80°F. and 50% humidity, the time required for this operation being about 24 hours. After the wheel has been balanced and the surface

broken up to provide resilience, the wheel is ready for use.

Silicate-base polishing wheel cements are increasing in popularity, particularly for fast, tough, coarse polishing operations. However, they have been used successfully for fine polishing operations also. The advantages realized, as compared to hide glue coatings, include: (a) application of the cement at room temperature as received from the manufacturer, thus eliminating the rather complicated set-up necessary for the application of hide glue; (b) drying operations may be conducted at higher temperatures, which decreases the time factor; and, (c) they can withstand the frictional heat generated at high polishing speeds much better than hide-glue adhesives. When silicate-base cements are used, it is essential that the recommendations of the manufacturer be followed.

Lubrication is essential to prevent gouging, when striving for a fine polished surface, and, to minimize frictional heat when polishing some of the softer metals. The most popular method of lubrication is by means of a tallow-grease mixture that is applied by friction from a bar to a rotating polishing wheel.

Permissible wheel speeds for polishing operations are usually from 6,000 to 8,000 sfm on wheels that have been bonded with hide glue, whereas, this speed may be increased to about 9,000 sfm for wheels bonded with silicate-base cement. Since frictional heat developed during a polishing operation is a function of wheel speed, there is a maximum permissible speed without deterioration of the wheel or without damaging the metal polished. On the other hand, a speed that is too low may result in the abrasive being ripped out of the wheel.

Buffing Operations

Buffing follows the polishing operation, producing a highly reflective surface free from scratches and other imperfections. This operation is frequently divided into cutting down and color buffing, each using a soft fabric wheel, a very fine abrasive, and relatively high speeds. In contrast to the polishing operation, the abrasive is not glued to the wheel but is applied to the revolving buff from a bar that is composed of an abrasive and a binder.

Flexible buffs are made from paper, sisal, cloth, or sheepskin discs. Buffs made of heavy paper discs or a combination of paper and cotton are used occasionally for cutting-down operations. Sewed wheels made of discs of sisal fiber in combination with muslin discs are sometimes used for cut-down buffing. Coloring operations may employ either Canton flannel and wool cloth buffs, loose buffs of sheepskin, or woven felt discs. However, the most widely used material in the construction of buffs is bleached or unbleached muslin.

The buffs under consideration will include loose buffs, packed buffs, sewed and pieced buffs, pocketed buffs, and string wheels. Loose buffs are made of full discs of muslin, sewed together around the center hole. The standard 48 x 48 thread count sheeting is used for high coloring of precious metals; the more popular 64 x 64 count sheeting is widely used in cutting down and coloring a wide variety of metals; the 80 x 92 count sheeting is used to cut and color aluminum, white metal, and silver; while, the 86 x 93 count sheeting is employed where maximum service and heavy work is anticipated. In the latter instance, this higher thread count buff is well adapted to cutting operations on large, heavy brass, copper, and nickel silver surfaces, and for coloring heavy nickel deposits.

A packed buff is similar to a loose buff with the exception that interspersed between every third or fourth disc are small discs of cloth or paper. This reduces the density of the buff face, permits air gaps between the cloth discs and results in cooler operation. The ratio of the larger to the small discs in this construction varies in accordance with service conditions. This type of buff is used effectively in buffing sheet metal where a loose buff might be drawn too tight by centrifugal force.

Full-disc sewed buffs, which are widely used for heavy, fast cutting, are made of discs that are held together by sewing radially, spirally or concentrically over the entire surface between the arbor hole and the periphery. This produces a harder faced, less flexible wheel than that obtained with a loose buff. Pieced buffs, made from remnants smaller than full discs, are also available and, when properly made, a substantial savings can be realized. These buffs are available in various grades of sheeting; the higher count buffs giving the faster cut. Construction of the buff will be similar with the exception that the spacing between the rows of stitches will vary to add to the stiffness.

A pocketed buff may be constructed so that crevices or pockets on the periphery of the wheel will collect the buffing compound. This same effect may be obtained by enclosing folded sheeting with full disc covers which, in addition to holding buffing compound, will increase the wearing qualities of the cloth and tend to ventilate the cutting surface. The pleated buff, with a rigid center disc of either metal, fiber or plastic, is another example of this construction. The problem of unraveling, inherent with this design, is minimized by the use of a lock stitch at intervals along the circumference of the buff. Pocketed buffs, which can be made of a variety of sheeting materials, are widely used where a fast cut is desired and the stiffness of a sewed wheel cannot be tolerated.

String, wick, and cord wheels resemble a circular brush with the muslin fiber radiating from the hub. These wheel types are widely used for buffing, the cord wheel being used for cutting-down operations where the contour is such that maximum flexibility is desired, whereas, the string wheel is preferred for finishing operations. A satin finish of varying brightness may be obtained with these wheels by controlling the abrasive and wheel speed.

Binders for grease-base buffing compositions are from a class that includes stearic acid, hydrogenated fatty acids, tallow, hydrogenated glycerides and petrolatum. The fatty acids seem to have an additional beneficial chemical effect during polishing by the formation of metallic stearates. The binder may also vary from low-grease to no-grease base compositions; an advantage of the latter binding is non-penetration

of the composition into the buff, which favors increased life.

Of increasing importance is the use of liquid spray buffing compositions in which the abrasive is suspended in an oil or grease-water emulsion. This air-spray-applied buffing composition, in which the spray gun is positioned in relation to the buffing wheel so that it will not interfere with the operator in manual buffing operations or with other parts of the mechanism when attached to automatic machines, is reputed to offer such advantages as:

(a) Efficiency — the buff is always coated with an optimum amount of the liquid composition, with its application being on a continuous rather than an intermittent basis. When bar composition is used, there is generally an excess of composition on the wheel immediately after application and a deficiency just before the next application. Thus, the first parts are buffed with too much composition and the last ones in the cycle do not have enough. With the spray method, each piece is buffed with the desired amount of composition.

(b) Low buff wear — the buffing wheel is worn unnecessarily when buffing is done with either an excess or deficiency of composition. With the spray-applied composition, the uniformity of application will eliminate excessive buff wear.

(c) Cleanliness — excessive amounts of bar composition applied to the wheel generally pack solid buffing dirt into the crevices of the article being finished. This has always presented a serious cleaning problem after conventional buffing. An excess of buffing composition is never present when the air spray method is employed, with the result that residual dirt is easily removed. In the event that an emulsifiable compound is used, the entire apparatus may be cleaned thoroughly with hot water without dismantling.

(d) Economy — production data indicate that 50% or less of the air spray buffing composition will be used, when compared to bar stock, for the same amount of work buffed. Spray equipment may be designed to permit close control of the amount of composition sprayed. In addition, there are no ends or nubbins of buffing composition left over which cannot be reclaimed efficiently.

(e) Safety — when using bar compositions, muslin buffing wheels have often caught fire when high pressures are used and a deficiency of compound exists. This is eliminated with the use of non-combustible, emulsifiable, liquid spray buffing composition which is added continuously with the correct amount to perform the buffing operation.

Buffing wheel speed is a variable that is not easily evaluated since there are other factors such as pressure application, buff design and compound formulation that will vary from shop to shop. The variation that normally may be expected in these factors may result in similar finishes at various wheel speeds. However, to serve as a guide, suggested speeds for hand buffing operations are given in Table 2; automatic buffing operations frequently may require speeds that may be slightly higher depending upon the specific part design and material buffed.

TABLE 2

Approximate cutting speeds in surface feet per minute (sfm) for various materials

	Cutting Down	*Color Buffing*
Carbon steel	9,000	7,000 to 9,000
Stainless steel	10,000	7,000 to 9,000
Brass and zinc	6,000 to 9,000	6,000 to 8,000
Nickel	6,000 to 9,000	6,000 to 8,000
Aluminum and other soft metals	6,000 to 8,000	6,000 to 7,000
Chromium	——	7,000 to 8,000

Finishing Various Metals

The finishing of metal surfaces, either to obtain an attractive surface on consumer products, or as a preparatory step for subsequent plating, will depend on factors which include the metal to be polished, the method and amount of forming that precedes surface finishing, the condition of the metal surface prior to finishing, and the character of the finish desired. Although there are practices existing in the finishing of metals that differ widely with respect to wheel speeds, wheel selection, and buffing compositions, a few comments as to a suggested procedure used for finishing the more common materials are given.

ALUMINUM AND ALUMINUM BASE ALLOYS:

These materials are relatively soft, with high coefficients of friction, and exhibit a tendency to cut away at the grain boundaries if overheated during an abrading action. These characteristics limit the choice of finishing procedures to those providing sufficient lubrication and minimum work-to-wheel pressure.

A roughing operation for the removal of gross defects is performed on semi-flexible, bonded muslin or canvas wheels faced with silicon carbide, grit 50 to 100 at a speed of about 6000 sfm. This speed may vary in accordance with the type of bonding that is used in the set-up wheel; a 5000 sfm peripheral speed is frequently given for glue-bonded wheels, whereas, a range from 5000 to 7000 sfm is given for cement-bonded wheels. Speed limitations are essential to prevent ridging or heating of the comparatively soft surface. A small amount of tallow, tallow-oil mixture, or an appropriate proprietary lubricant may be used sparingly to reduce frictional heat. A refined roughing operation for the removal of small defects and the production of a surface of uniform finish employs a soft felt wheel operated about 6000 sfm and faced with aluminum oxide, 100 to 200 grit, suspended in a suitable binder. Care must be taken to prevent overheating and subsequent loading of the wheel. Excess aluminum pick-up on the wheel will result in deep scratches on the metal surface.

Buffing operations are conducted with sewed, muslin discs operated at speeds of about 7000 sfm. A fine abrasive, such as tripoli mixed with a grease binder, is suggested. Coloring operations are similar to buffing, with the exception that an open muslin buff is used in conjunction with a softer silica

abrasive in a grease binder. In addition, higher wheel speeds of about 8000 sfm are employed, while a very light work-to-wheel pressure is recommended.

Satin finishes are produced at wheel speeds ranging from 3000 to 5000 sfm. A greaseless composition containing an abrasive, or a mixture of abrasive bonded together with glue, is employed. When applied to a revolving wheel, sufficient heat is generated by friction to cause the compound to melt and be transferred to the wheel. Aluminum oxide, 200 grit, aluminum oxide-silicon carbide 200 grit mixture, or a 240 grit aluminum oxide abrasive frequently is used in conjunction with loose muslin buffs, string or wick wheels, or ventilated or bias buff wheels. A mat finish is produced with aluminum oxide abrasive, 200 grit, on sewed buff wheels operated at about 5000 sfm. This combination will develop the heat necessary to produce the desired frosted finish.

MAGNESIUM BASE ALLOYS:

The operations employed in finishing the magnesium base alloys are very similar to those used for the aluminum base alloys, with the exception of certain magnesium alloys that are harder. As a result, dragging or tearing may be reduced and it is not usually necessary to use as much lubrication as in the case of the aluminum alloys. A few suggestions are given in finishing this class of material.

Rough polishing may be performed on canvas, sheepskin, or felt wheels, operated at 5000 to 7000 sfm depending upon the wheel diameter, with a silicon carbide abrasive grit, No. 60 to 100. A grease stick lubricant may be used. Medium polishing operations for the removal of slight imperfections may be performed on a built-up cloth wheel operating at 4000 to 7000 sfm with silicon carbide, 100 to 200 grit, or an aluminum oxide-silicon carbide abrasive grit mixture. A grease stick may be used.

Dry-fining is performed with a greaseless compound on loosely sewed buffs at about 6000 sfm. Buffing operations are performed on a high count, loosely-sewed wheel, utilizing a greaseless-base tripoli compound, operating at about 7000 sfm. Coloring operations frequently use a Canton flannel buff operating between 8000 and 12000 sfm, utilizing a greaseless abrasive of dry lime. These finer finishes require a minimum of work-to-wheel pressure to produce a satisfactory luster.

COPPER AND COPPER BASE ALLOYS:

The removal of spinning marks, pits, and small defects from soft copper is accomplished with a 200 grit aluminum oxide abrasive on a loose muslin buff operating at a speed of about 6000 sfm. When a bright finish is required on a solid copper casting or extrusion, a typical procedure is:

(a) flexible polishing with aluminum oxide, 200 grit, on a muslin buff with 3/8 inch spiral sewing, at about 5000 sfm;
(b) cut-down buffing with coarse tripoli in a grease binder on pocket or ventilated buffs, at about 7000 sfm;
(c) cut-and-color buffing with medium-coarse tripoli in a grease binder on full disc or pocketed buffs, at about 7000 sfm; and,
(d) color buffing with a fine unfused aluminum oxide powder on a loose muslin buff, at between 6000 and 7000 sfm.

About every known wheel type and abrasive compound has been employed in the finishing of brass and bronze. The results obtained in an operational sequence in the finishing of these popular copper-base alloys depends upon the abrasive, wheel type and surface speed of the wheel. In general, the coarser abrasives, as exemplified by 120, 150 and 200 grit aluminum oxide, will produce a dull finish. Soft-faced wheels and low-surface-speed wheels will also produce a dull finish; however, a brighter surface may be realized by using a more rigid type wheel or a higher surface speed with the same grade of abrasive. A high luster buffing, particularly where either contours or ornamentations tend to pack up with ordinary buffing compositions, a suitable grade of tripoli, lime, silica, or a combination of these abrasives embedded in a no-free grease binder should be used.

TABLE 3

Surface Speed of Wheel in Feet per Minute (To Nearest 10 Feet)

Arbor Speed r.p.m.	DIAMETER OF WHEEL 2"	4"	6"	8"	10"	12"	14"	16"	18"
800	420	840	1260	1680	2100	2510	2930	3350	3770
1000	520	1050	1570	2100	2620	3140	3670	4190	4710
1200	630	1260	1880	2510	3140	3770	4400	5030	5650
1400	730	1470	2200	2930	3670	4400	5130	5860	6600
1600	840	1680	2510	3350	4190	5030	5860	6700	7540
1800	940	1890	2830	3770	4710	5650	6600	7540	8480
2000	1050	2100	3140	4190	5240	6280	7330	8380	9420
2200	1150	2300	3450	4600	5760	6910	8060	9220	10370
2400	1260	2510	3770	5030	6280	7540	8800	10060	11310
2600	1360	2720	4080	5450	6800	8170	9530	10890	12250
2800	1470	2930	4400	5860	7330	8790	10260	11730	13190
3000	1570	3140	4710	6280	7850	9430	11000	12570	14140
3200	1680	3350	5020	6700	8380	10050	11730	13410	15080
3400	1780	3560	5340	7120	8900	10680	12430	14250	16020
3600	1880	3770	5650	7540	9430	11310	13200	15080	16960

Recommended polishing speeds with conventional wheels are around 7000 sfm. Aluminum oxide, 150 grit, is frequently used at 6000 sfm for polishing brass with sewed buffs, canvas, felt, or solid leather polishing wheels. With rigid wheels and heavy compound heads, the use of a grease-base, medium-coarse tripoli is recommended as a lubricant. An intermediate flexible polishing operation is suggested for the removal of small defects and flash. Aluminum oxide, 200 or 240 grit, in a suitable binder, is used on sewed buffs or loose muslin sections at about 5500 sfm. To produce a brighter finish, a suggested combination would be the use of aluminum oxide, 240 grit, on a loose muslin buff at 3000 to 5000 sfm. Coloring is performed with either coarse tripoli in a grease binder, or a fine lime or silica embedded in a no-free grease binder on a loose muslin buff operated at 7000 to 8000 sfm.

A satin finish on copper would require polishing on loose muslin buffs, ventilated or bias buffs, string or wick wheels, operating from 4500 to 6000 sfm. Either a 200 grit aluminum oxide or emery embedded in a greaseless stick may be used. Satin finishes on either brass or bronze are produced at surface speeds between 3500 to 5500 sfm with a greaseless stick containing 150 to 200 grit aluminum oxide or a combination of 200 grit aluminum oxide-silicon carbide abrasive. Loose muslin buffs, ventilated or bias buffs, string and wick wheels with or without a lubricant may be used, the choice depending on the line effect desired.

NICKEL AND NICKEL-BASE ALLOYS:

The number of operations required for this class of alloys depend on the "base" polishing procedure necessary to remove all surface imperfections. The coarser the abrasive required to produce this "base," the greater will be the number of operations to produce the desired finish.

Recommended polishing speeds for nickel and nickel base alloys may vary from about 6500 to 7500 sfm, whereas, the suggested wheel types would include sewed buffs, canvas, and leather polishing wheels. To remove small defects, intermediate flexible polishing is recommended, using either a 200 grit silicon carbide-aluminum oxide mixture or an aluminum oxide abrasive, on sewed buffs at wheel speeds of approximately 6000 sfm. Nickel-silver flatware usually employs an aluminum oxide abrasive, 200 grit, for polishing on packed muslin buffs at about a 2400 sfm.

In the preparation of nickel-silver for plating, a cut-down buffing operation would consist of polishing on either pocketed or ventilated buffs at about 8000 sfm with a coarse, grease-base tripoli compound. Cut-down buffing on high nickel alloys would employ a loose muslin buff at about 7500 sfm with a coarse, grease-base fused aluminum oxide compound. This is followed by a coloring operation on the same type of wheel that is operated at about the same speed, using a fine chrome rouge compound, the buffing bar being a no-free grease type but containing sufficient lubricant to work efficiently and cleanly. In addition, high-count muslin buffs are preferred for final finishing as the tightly twisted fibers give better cutting and usually result in longer wheel life.

For the production of a satin finish, the aluminum oxide-silicon carbide abrasive of about 200 grit in a greasless binder is used in conjunction with a high-count, full-disc muslin buff at about 5500 sfm. Butler finishing, which is usually carried out after a bright finishing operation, is obtained by using a soft powdery abrasive and special greaseless binder at about 5000 sfm.

STEEL AND STAINLESS STEELS:

Although stainless steels are considered harder than steel and, frequently, requires more time to obtain the desired finish, the procedures that are employed for these two materials are very similar. Thus, even though the basic characteristics of these materials differ considerably, the finishing operations may be considered as a single unit. Mirror and high luster finishes are not obtained easily, with the result that costs may be relatively high. However, semi-bright satin and butler finishes may be obtained at competitive costs and, as a result, are used most frequently. Another factor to consider in polishing these materials is that work-hardening and, possibly, structural transformations may complicate a finishing procedure.

Polishing is usually done on sewed muslin, canvas, solid leather, sheepskin, or felt wheels at speeds of about 6000 to 8000 sfm. The number of operations in a polishing sequence is dependent upon the surface condition of the part; the shallower the surface imperfection, the less coarse will be the initial abrasive to obtain a satisfactory "base." On curved or irregular surfaces, flexible polishing with silicon carbide abrasives is recommended at wheel speeds of about 6000 sfm, on sewed buffs that are properly sized. Cut-down buffing is performed at 10,000 sfm on a pocketed type buff with a grease base, medium coarse to coarse aluminum oxide powder. Subsequent coloring operations generally use the same type of wheel and wheel speed with a greaseless, fine chrome rouge compound having sufficient lubricant to work clearly and efficiently.

To produce a final satin finish on articles fabricated from rolled stainless steel with good surface characteristics, a 150 grit silicon carbide or a 200 grit mixture of aluminum oxide and silicon carbide is used in conjunction with a loose or pocketed type muslin buff at about 4500 to 5500 sfm. A widely used flexible wheel satin finishing of steel involves the use of a suitable grade of iron-free compound in a greaseless stick applied either to a loose, soft muslin buff or to a string wheel. This is a dry method of finishing; the work requires no cleaning or wiping after this operation. The wheel may or may not require lubrication depending upon the type of alloy and the characteristics of the surface. If dragging or an opengrained appearance is obtained some lubrication may be necessary, this procedure frequently producing a brighter satin finish when compared to that obtained with the unlubricated wheel. The lines on the final operation should run in the same direction as the original rolling or the previous polishing operation.

To produce a butler finish showing no surface de-

fects, a 240 grit aluminum oxide abrasive embedded in a greaseless composition is used in conjunction with a sewed, loose or pocketed type muslin buff operating at about 5500 sfm.

ELECTROPLATED METALS:

The "base" prior to electrodepositing chromium should be finished to meet the requirements of the specific item, this being particularly necessary on decorative chromium where the deposit is about 0.00002" thick. If the final finish is to be a high color, this should be imparted to the metal beneath the chromium plate or, if a satin chrome is desired, this should be produced before chromium plating. Slight fogging may be experienced; however, this may be removed by color buffing with relatively fine, soft unfused aluminum oxide powder that is lubricated slightly. A loose, muslin buff is generally used at a wheel speed of about 7000 sfm. In the event that a burnt deposit is obtained, a cut-and-color buff is suggested with a lubricated, medium-grained combination of fused and unfused aluminum oxide powder on a loose muslin buff operated at about 8000 sfm.

Heavy chromium must be treated as if it were a solid metal. In a flexible polishing operation, where both a fast cut and a smooth finish are desired, a 150 grit silicon carbide compound is used in conjunction with a sewed muslin, felt wheel or loose buff depending upon the amount of abrasion desired. A greaseless stick is preferred. Sized, sewed buffs or felt wheels are used for heavy cutting. Small defects, burns, etc. are removed in a flexible polishing operation with 200 or 240 grit aluminum oxide compound on sewed buffs or loose muslin buffs.

Bright finishing for hard chromium plate is produced with a loose muslin buff or string wheel operating at about 5000 sfm, utilizing a lubricated fused aluminum oxide abrasive. The same wheel type and speed are employed in obtaining a satin finish with a 200 grit abrasive consisting of a mixture of aluminum oxide and silicon carbide. A greaseless binder is preferred. Butler finishes may be obtained with a 300 grit special silica powder in a greaseless binder utilizing a packed, loose muslin buff that operates at about a speed of 5000 sfm. This operation usually follows a bright finishing operation.

Copper may be deposited on either steel or zinc die castings to protect the basis metal against a corrosive environment. In this application, the finish on the basis metal is of secondary importance and, frequently, a fairly coarse polished surface may be covered by a heavy copper deposit in the order of about 0.001" in thickness. In the event that a copper deposit is required on a zinc die-casting, the preparatory operations would include flexible polishing followed by a cut-down buffing operation. After the die casting has been trimmed, polishing is performed on a sized felt or canvas wheel coated with 120 grit aluminum oxide abrasive; the wheel operating at a speed of about 5000 to 6000 sfm. This is followed by a cut-down buffing operation where a grease base, tripoli powder is used in conjunction with a sewed or pocketed buff operated at about 8000 sfm. The work piece is now ready for the copper plate.

Generally, copper is an intermediate deposit that is followed by both nickel and decorative chromium electroplates. To obtain a high color in the final deposit, the copper deposit is given a cut-and-color buff with a lubricated, coarse tripoli compound using a pocketed muslin buff that operates at about 7000 sfm. This may be followed by bright nickel and decorative chromium deposits without further buffing. In the event that a soft nickel deposit is employed, as exemplified by that obtained from the Watt's bath, it is necessary to color the nickel deposit with a slightly lubricated, unfused aluminum oxide or lime compound on a loose muslin buff operated at about 7000 sfm; this being followed by the decorative chromium.

If the final chromium plated surface requires a satin finish, both the copper and nickel underplates should follow a procedure that will result in this satin finish. On a relatively heavy copper deposit, a satin finish may be obtained with a 200 or 240 grit aluminum oxide embedded in a greaseless binder, on a loose muslin buff operated at about 5000 sfm. A similar operation is performed after the Watt's nickel deposit is obtained, observing the precaution that the lines produced in the finishing of the copper deposit be followed in the satin finishing of the nickel electroplate. For heavy deposits of nickel, a 200 grit aluminum oxide greaseless compound on a loose muslin buff is employed, whereas, the thinner deposits require a finer emery or silica compound, which is used in conjunction with a soft, packed, muslin buff. The wheel speed may vary from 4500 to 4000 sfm; the speed decreasing as the nickel deposit becomes thinner.

In the silverware field, wear-resistant silver is electrodeposited on such metals as nickel-silver, brass, steel, etc. The basis metal is brought to a smooth finish by a cut-down buffing operation previously described. The desired finish on silver plate is usually mirror bright or a butler finish. A mirror finish may be obtained with a greaseless red rouge compound employed in conjunction with a loose muslin buff that is operated at a speed of about 7500 sfm. A butler finish may be obtained with a soft powdery abrasive, usually a 350 to 450 grit abrasive, embedded in a greaseless binder, on either a full-disc or packed, muslin buff operating from 7000 to 7500 sfm.

Where a bright butler, relieved, oxidized finish is required, the item is oxidized immediately after the silver plating operation. The parts are then relieved and butler finished in one operation with a 350 grit soft, powdery abrasive embedded in a greaseless binder, on a loose muslin buff operating at 7500 sfm. To obtain a coarse, satin finish on the bottom of silver plated holloware, a 150 grit aluminum oxide compound is used in conjunction with a loose muslin buff at about 5000 sfm. The remainder may be finished either as a bright or semi-bright butler finish.

Acknowledgement is made to *Dr. H. L. Kellner* and the *Lea Mfg. Co.* for assistance in the preparation of this article.

Traveling Booth for Spraying Railroad Cars

By Zeke Cook

MANUFACTURERS faced with the problem of finishing large equipment may find some applications from the Erie Railroad's new automatic paint setup which finishes a 50-foot freight car in nine minutes.

Some of the newer advances in railroad finishing equipment are installed in the Erie's new $4 million car shop at Meadville, Pa., which is a complete rebuilding and refinishing operation.

Most of the effectiveness of the refinishing department is the company's automatic traveling spray booth. It can handle up to 24 cars per day with allowance for preparation time, a lunch break and cleanup, because it does more of the job automatically than any other installation in the industry. And this unit is supplemented by a manual traveling spray booth with a capacity of up to 12 cars per day.

Erie officials helped tailor the spray finishing installation to the railroad's needs. As a result, whether working at full capacity or at a reduced pace, the new refinishing system is more efficient and more economical than prevoius methods of finishing rolling stock.

Because of the savings in material, time and labor costs, it is expected that the investment of more than $100,000 in finishing equipment will be repaid in a matter of months.

Cars arrive in the finishing department after first being repaired and/or rebuilt in the main repair and assembly shop, and then passing through a sand-blasting and undercoating area. They move on two sets of parallel tracks through electrically operated overhead doors into the 400 ft. by 46 ft. finishing building.

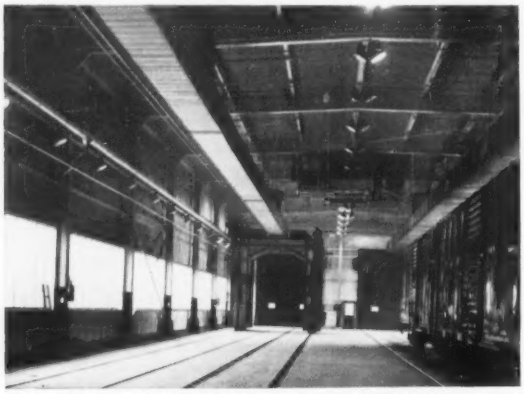


Fig. 1. The refinishing department of the Erie Railroad's new car shop at Meadville is 400 feet by 46 feet, with two sets of parallel tracks to handle its two traveling spray booths. The automatic booth is in the background. A complete exhaust system, duct work for which is visible, carries off overspray and assures fresh air, heated when needed, through a tie-in with the heating system of the building.

Photos courtesy of The DeVilbiss Co.

One set of tracks is served by the automatic booth and the other by the manual booth. Each set will accommodate eight cars.

Boxcars or cars of uniform size are scheduled for the automatic line. Overflow or miscellaneous types of cars are sent in on the manual line. The automatic spray booth is flexible and can be adjusted to paint boxcars, gondolas, hopper or any other type of freight car. It is most efficient, however, for types like boxcars. It is used with maximum efficiency, of course, when cars of the same type are scheduled on the line for a run. Adjustment of the equipment is, in this latter case, not required between individual cars.

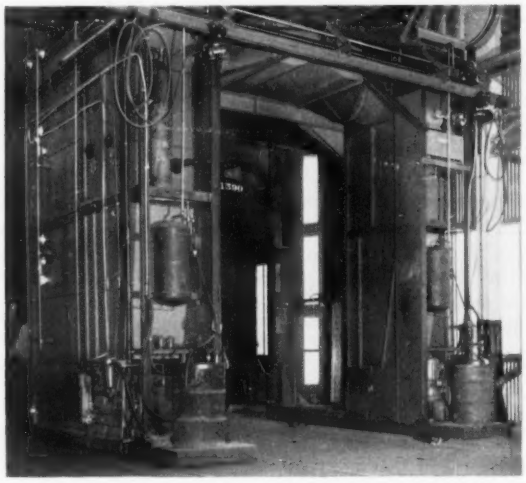


Fig. 2. The automatic and manual traveling spray booths are completely integrated. Each is self-propelled, with air wash exhaust system, water pump, exhaust fan, regulator, lighting, even an automatic fire extinguisher system built in. Capacity of these booths is 220 gallons — four 55-gallon drums (two are shown) hooked to the paint system. A monorail conveyor (top) and chain hoist is provided for rapid interchange of drums.

On the automatic line, the sides and tops of the cars are sprayed mechanically, with the ends finished manually by painters working from air-driven scaffolds and scaffold extensions. Stenciling the railroad's insignia is also done manually on an area shielded when the rest of the car is painted. In the manual booth, painters work from power-driven scaffolds on each side as well as from scaffolds at the end of the booth for painting the ends of the cars.

The cars are finished with quick-drying enamel and given a wet coat of from 4-5 mils thickness. Each booth has paint-heating equipment so that the material is delivered to the spray guns with higher viscosity, thereby attaining heavier film builds with reduced overspray and air consumption. Finishing materials are stored in an adjacent heated area, with a supply of at least one month kept on hand. Preparation of the material is also done in the storage room.

Each booth has a capacity of 220 gallons, or four drums, of material — enough to finish eight cars. There is a monorail conveyor on each booth equipped with a chain hoist to lift the pump and lid and allow rapid replacement of the material drums. The spray system is hooked up to draw from any drum as long as material remains.

The automatic booth combines a horizontal transverse unit for coating the tops of cars with two vertical transverse units for coating the sides. Each has two spray guns, or a total of six, all of the internal mix type. This provides faster coverage at

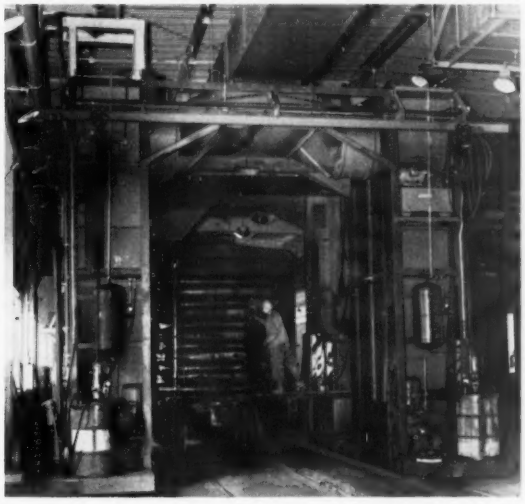


Fig. 3. The automatic traveling paint spray booth will finish the top and sides of a box car with the ends being finished by spraymen working from power-operated scaffolds. A 50-foot car can be finished in nine minutes, including stenciling of the railroad's insignia. A wet coat of enamel of from 4 to 5 mils thickness is applied.

lower pressures than external mix types for these purposes. The manual spray stations in this booth are equipped with separate spray guns of the conventional type.

The inverted U-shaped booths travel at speeds up to 25 feet per minute on separate rails which parallel the track rails and are self-propelled by hydraulic power. Each occupies a 12-foot area parallel with the track and 18 feet transversely. When the largest cars are straddled by the booth, the clearance between the booth and the top and sides of the cars is about 6 inches.

Each booth has a working space off the side which is seven feet long with access doors at one end. The power-driven scaffold moves up and down for proper working height within this area and is controlled by the painter. Lighting is provided by glass enclosed, explosion-proof fluorescent fixtures, carefully located

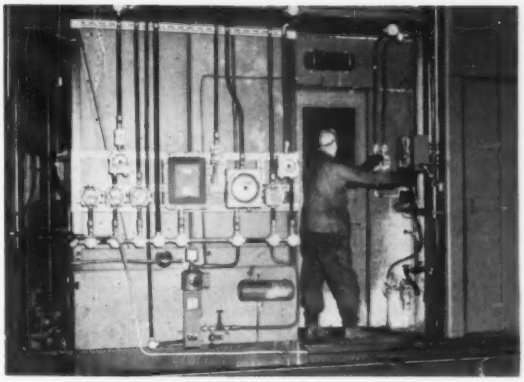


Fig. 4. Operator at the control panel of the automatic traveling spray booth. From this point he can control the movement of the booth as well as the spray operation, watching the finishing operation through the window. Some of the piping for circulating the heated material used in finishing the rolling stock is shown.

to floodlight the working surface and eliminate any shadows which might hamper the painter.

Each side of the booth is also provided with an air-wash exhaust system, a paint tank, an air regulator, a spray gun and hose, an air compressor for operating the spray gun, and an explosion-proof electrical control system. There is a completely automatic carbon dioxide fire extinguishing system in each booth.

The traveling booth also performs an air-conditioning" function. When the exhaust fans are turned on, a suction is created throughout the air-wash chamber on each side of the booth. As a result air enters the narrow space between the booth and the car, as well as through filtered intakes, and flows at a relatively high velocity along the periphery of the car and into the air-wash chambers, carrying with it all over-spray from the paint-spray guns.

The air is cleaned of pigment in the air-wash chambers and then discharged into exhaust pipes leading from the tops of these chambers. The exhaust pipes in turn discharge the air into fixed, continuous exhaust ducts suspended from the ceiling and running the full length of the building directly over the center line of the tracks.

The bottom of these ducts consists of a series of pivoted louvers. As the booth moves along, the louvers are opened successively by cams on the top of the booth. Only enough louvers are lifted at a time to provide an opening in the continuous exhaust duct equivalent in area to the discharge ends of the exhaust pipes leading from the air-wash chambers. Separate exhaust fans draw the air through the fixed exhaust duct and discharge it into the outside atmosphere.

There are two exhaust systems, one for each booth, hooked to the heating system of the building. When the booths are in operation, heated fresh air is provided for the area. When the booths are not operating, dampers close, and a recirculating system is used.

The entire department is manned by a paint leader and two spray men, representing a substantial saving in labor costs. There is also a saving in material costs and in time. Further, the automatic booth provides a superior finish, since it applies a more uniform coating than can be achieved by manual methods.

Bulk Bright Dipping

By J. C. Brown, *Chief Mfg. Engineer, Lamp Div., Westinghouse Electric Corp., Belleville, N. J.*

THE general type of base by which incandescent lamps are inserted into and held in electric light sockets was originated by the Old Edison Lamp Works and has been standard since about 1890. Therefore, from the time that the Belleville Base Works of Westinghouse Electric Corp. began manufacturing operations in 1923, these same type of bases have been produced. Due to the materials and the processes used in making these bases it has been necessary to subject them to a bright dipping operation before packing and shipping them. There are some twenty major varieties of bases, ranging in size from the small flashlight base to the base used on large lamps for street and floodlights, with each variety having from three to six sub-types. Each kind must be processed through all the operations, including bright dipping, separate from all other types.

Two basic materials have been used to make lamp bases, viz. brass and glass. Brass is used to make the metal shell and the eyelet contact. Glass is used to combine the shell and eyelet in proper relation to each other with the correct amount of glass insulating material separating the two metallic parts. This combination is effected by placing the eyelet and the shell in their proper relative positions in a heavy metal holder, then flowing molten glass into the same holder and forming the glass into the proper shape. The heat from the melted glass causes the surface of the metal eyelet and shell to be rather oxidized. This heavy oxidation has to be removed and a shiny bright surface obtained which is pleasing in appearance. Since both eyelet and shell are brass, the logical solvent is a mixture of nitric and sulfuric acids. The nitric acid dissolves the brass readily while the sulfuric acid slows down the chemical action so that only the metal surfaces are dissolved and left clean.

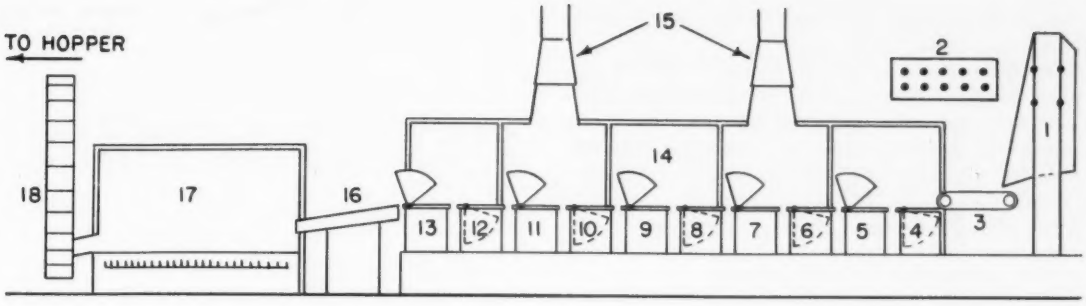
About twenty-five years ago, it became evident that some mechanical automatic process would have to be developed to replace the relatively slow and costly hand dipping operation, since base requirements were rising to a point where it became increasingly difficult to clean bases as fast as they were needed. So a prototype machine was built and operated to determine the best cleaning bath compositions, the essential washing operations, the best materials to use for tanks and dipping baskets, and the most efficient cleaning cycle.

To eliminate all the bugs, this prototype machine was operated for about eighteen months. During this same time, an active survey of commercial cleaning units was conducted to determine the availability of industrial cleaning equipment that would meet the requirements which were deemed essential. None was found that would do what was wanted. So the Base Plant personnel designed, built, and installed their own automatic bright dipping unit. This included a gas-fired rotary sawdust dryer which was connected directly to the bright dipping unit. This entire unit was installed in 1935 and has been in continuous operation ever since that date. In the entire period since that date, there has never been a major breakdown. When any equipment repair or replacement was needed which could not be performed in two or three hours, it has been scheduled for a week-end or for the annual two weeks summer shut-down period. By following this procedure faithfully, it has been possible to keep this unit in continuous operation over the years.

The Dipping Machine

The primary cleaning unit consists of ten rectangular shaped tanks in line. The tanks are built of stainless steel. There is a dip basket for each one of the ten tanks. These dip baskets have stainless steel frames covered by stainless steel wire mesh. Each dip basket is firmly attached to a horizontal shaft extending all the way across the front end of each tank. The basket moves through an arc of 90° — only because the shaft rotates that much. The basket has a straight vertical front; the two side panels are also vertical, while the bottom and back side are blended into an arc. Each basket, as it comes into the "up" position has a slight overthrow beyond its 90° travel. This causes the basket to discharge its load into the basket beyond which is the down position. The entire series of baskets is operated by a sprocket and chain drive unit. When the odd numbered baskets are in motion, the even numbered baskets are at rest in the down position. And, when the odd numbered baskets come to rest in the down position, then the even numbered baskets begin to move. This alternating motion is governed by a reversing arm, which travels through an approximate 180° arc where it hits a mercury switch. This, in turn, causes the arm to travel back to its starting point. Thus, when the entire machine is in operation, this reversing arm is constantly in motion, forward about a fixed center through an arc of 180°, then backward through the same arc, after which it continuously repeats its cycle.

In addition to the basic machine, there is quite an array of auxiliary equipment. At the beginning end of the machine, there is a big overhead hopper, fed by a vertical lift hoist with a dumping arrangement. This hoist is operated by push button. Located just below the hopper chute is an automatic weighing scale, the platform of which is a motor-driven belt conveyor. This



SECTIONAL VIEW OF BRIGHT DIPPING EQUIPMENT

IDENTIFICATION OF VARIOUS SECTIONS OF THE AUTOMATIC BRIGHT DIP MACHINE:

1. Hopper for bases ahead of bright dip; 2. Panel board with switches for controlling the dip machne and the various items of auxiliary equipment; 3. Automatic Weighing Scale; 4. Dilute soap bath; 5. Cold water wash; 6. Drain tanks; 7. Bright Dip bath; 8. Cold water wash; 9. Cold water wash; 10. Hot alkaline soap bath; 11. Cold water wash; 12. Hot water wash; 13. Hot water wash; 14. Glassed in enclosure; 15. Exhaust ducts for fumes; 16. Vibrator screen; 17. Gas fired rotary dryer, and 18. Bucket elevator.

weighing scale is tied directly into the time cycle of the basic machine which is known locally as "the dip machine."

At the exit end of the dip machine, there is located a vibrating screen. This screen receives the cleaned bases from the last in-line basket and discharges them into the back end of the gas fired rotary dryer. At the discharge end of the dryer a vertical lift bucket elevator is located. This is used to carry cleaned bases from the discharge end of the dryer to the floor above where they are dumped onto a short horizontal conveyor belt. From this short belt they are discharged onto a long conveyor belt and then to large, overhead storage hoppers ahead of a visual inspection.

Other auxiliary pieces of equipment which are very important are located on the floor below. These consist of tanks for the acid cleaning solution, a tank for a plain soap solution, a tank for an alkaline soap solution, and pumps for charging these solutions from their holding tanks into the proper tank in the dip machine. Also, there is a pump for pumping raw acid, as purchased, into the holding tank. All of these solutions are charged into the various dip machine tanks under the control of a dip machine operator who is on the first floor and who simply pushes the correct button on a panel board which is located on the side of the dip machine.

The entire series of tanks, making up the dip machine, is hooded by a glass housing, with exhaust fans set in the roof of the housing to remove fumes. In addition, there are automatic temperature controls for the contents of each heated tank, perforated air lines in the bottom of each tank for agitation purposes, water lines to the tanks needing water, with motorized valves automatically controlling the flow, and the overflow lines for each tank, so that cleaning tanks may have clean wash water at all times. The entire operation is set up so that the operator can obtain maximum machine efficiency with a minimum of manual effort.

The Bright Dipping Process

First the various tanks in the dip machine itself are filled with the correct solution and heated to the proper temperature. The proper sequence is shown below:

Tank #1—A dilute hot soap solution — Temperature 75-80°C.

Tank #2—Cold water wash — small but continuous overflow.

Tank #3—Drain position.

Tank #4—Nitric-sulphuric acid cleaning solution—42-45° Be.—temperature not to exceed 75°C. Set to overflow constantly.

Tank #5—Cold water wash — Set to overflow continuously.

Tank #6—Cold water wash — Set to overflow continuously.

Tank #7—Hot alkaline soap solution — Temperature — 80°C. minimum.

Tank #8—Cold water wash — Set to overflow continuously.

Tank #9—Hot water wash — Small but continuous overflow — Temperature — 80°C. minimum.

Tank #10—Hot water wash — Small but continuous overflow — Temperature — 80°C. minimum.

With the contents of the tanks all properly set, bases are loaded by means of the vertical lift dumping hoist into the dip machine hopper, the scale weight on the beam of the automatic weighing scale is set to the selected point to give the proper number of bases per charge, then the starting button of the dip machine is pushed. Bases will be discharged from the hopper onto the weighing scale and thence to the first dip basket. After that, the automatic cycle of the machine takes over and the bases are moved from one tank to the next until the cleaned bases are discharged from the last tank onto the vibrating screen, after which they pass through the sawdust dryer. The bases are gradually moved forward through the dryer by means of baffles. The hot sawdust does two things: it dries up the moisture that is on the bases and it burnishes the surface of the bases slightly. The bases fall from the front end of the dryer and are picked up and lifted to the floor above by the bucket elevator. From this they are discharged onto a conveyor belt,

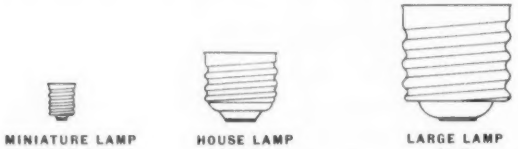
and then to another belt and finally into overhead hoppers to be inspected.

There are two fundamental steps in the bright dipping operation. First is the bright dip solution itself. The accompanying chart shows that there is a vast number of combinations of percentages of sulphuric acid, nitric acid, and water which will produce a clean bright surface on oxidized brass. However, it was found that the small irregularly closed area in the lower right portion of the chart gave the very best results. In this area the bright dipping action is very rapid — a few seconds immersion is sufficient. Also the surface finish is very bright. One very important precaution must be observed — the parts must be transferred very rapidly from the bright dip bath to the rinsing tank. If this transfer is delayed longer than a few seconds, the freshly cleaned metal surface will cloud over due to rapid re-oxidation.

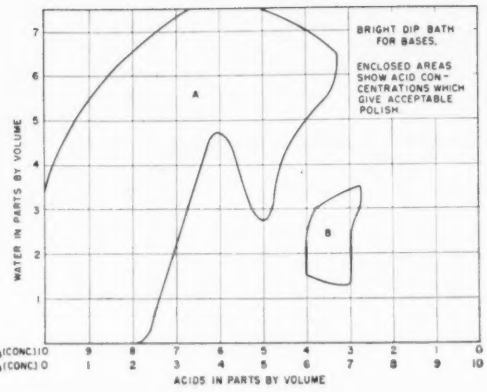
The second important step is the immersion of the bases in the hot alkaline soap solution, which follows the two successive cold water rinses. The soap solution is kept alkaline so that any traces of acid that may adhere to the bases after the cold water washes are neutralized. The hot soap solution coats the bases with a thin film of soap which hardens and forms a protective coating which prevents oxidation for a period of months, and sometimes longer.

To any one accustomed to thinking in terms of individual pieces, the quantities of bases processed through this automatic equipment must seem almost fantastic. At present about 2,000,000 parts are bright-dipped daily. One half of this number are bases for the standard house lamp; the remainder vary in size from the base for the flashlight bulb to the base for street-lighting and large flood-lighting lamps. These 2,000,000 bases are bright dipped in two eight-hour shifts. There have been times when three and one half million bases have been cleaned in a single day, with the dip machine being operated two ten-hour shifts. Translated into monthly production quantities, a 2,000,000 daily figure means 40,000,000 per month or a yearly total of 480,000,000 bases. Using these same data, it is seen that the average cleaning rate is 125,000 bases per hour.

With an acid bright dipping process, such as that described above, there is a waste disposal problem for the acid dragout which is removed from the bases in the washing and rinsing tanks. The overflow from these acid rinse tanks is carried through stainless steel piping to the floor below and flows into a series of four 6′ x 6′ x 6′ cypress tanks which have a grated flooring. These tanks are filled with broken dolomite (calcium and magnesium) limestone. The waste acid is all introduced into the first tank at the top then, by means of a built in channel, is delivered



SAMPLE BASE TYPES



to the bottom of the second tank, flows up and over into the third tank, then up through the fourth tank, after which it flows into a large pipe which discharges into the sanitary sewer.

The limestone does a very adequate neutralizing job but there are certain precautions which must be observed if it is to function properly. First it must be dolomite limestone. Straight calcium limestone is completely unsatisfactory, since the greater proportion of the acid waste is sulfuric, which reacts with calcium limestone to form highly insoluble calcium sulfate. The calcium sulfate deposits on the surface of the limestone and, due to this build up, the limestone rapidly becomes inactive and loses all its ability to neutralize. With dolomite limestone, the surface of the stone does not become inactive, since the very soluble magnesium sulfate is formed, along with the calcium sulfate. This prevents any excessive build-up of the insoluble calcium sulfate.

Secondly, the acid waste, as it flows into the neutralizing tanks, must have a total acid content of not more than 0.35%. Any higher percentage of acid will cause the excessive formation of insoluble calcium sulfate. Third, the rate of flow of liquid through these tanks must not be too rapid or neutralization will not be adequate. Finally, all soapy or oily waste must be kept away from the limestone-filled neutralizing tanks. For, if any of these soapy wastes solutions get carried into these tanks, a soapy film forms on the surface of the stone, rendering it inactive.

There is a sizable volume of plain soap and alkaline soap solution waste and it was thought originally that these alkaline wastes could be used to help neutralize the acid wastes. But, when it was found that the waste soap solutions quickly rendered the limestone inactive, separate drain lines were installed to carry these solutions directly to a sump, from whence they were pumped into the external sanitary sewer lines.

In conclusion, a comparison between the old hand-dipping process and the present automatic operation should tend to show what a vast improvement has been made. First, one man operating the automatic dip machine bright dips bases seven times as fast as the old time hand dipper and with not more than one seventh of the physical effort required. Second, he does it with much greater personal safety.

(*Continued on page 79*)

Multicolor Coatings for Corrosion Protection

By Norman I. Gaynes

FOR many years it was standard among all humorously inclined paint men to talk about polka dot or striped paints. Thanks to the wonders of modern research one of these materials, polka dot or multicolor enamels have been in existence for nearly a decade. This humor squelching concept makes it possible to apply two or more colors in one spray or rolling application.

Normally, when two lacquers are mixed simultaneously as for example black and white, the resultant is a gray homogeneous lacquer. However, in this multicolored product each of the lacquers forms individual discrete particles. Thus the white will occur as small white particles and the black also will retain its own true color, producing an interesting combination pleasing to the eye. The potential therefore is infinite, for there is unquestionably no limit to the number of colors which can be chosen; hence the possible combinations are completely unbounded, particularly when one considers that, by altering the material manufacturing procedure, particles of varying sizes can be produced. There is no doubt therefore that even the most discriminating interior decorator can choose a multicolor enamel to match the decor of any room or furniture.

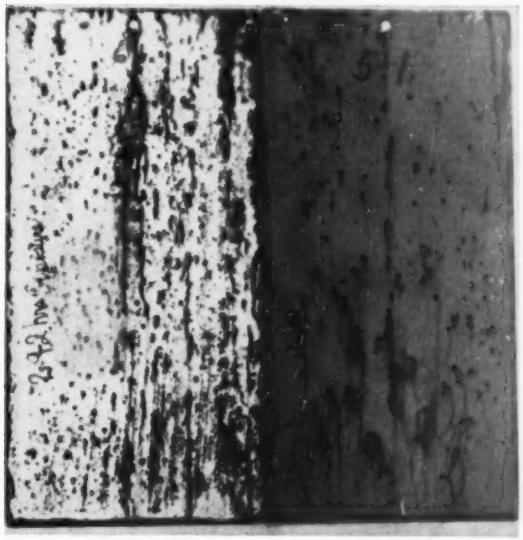


Fig. 1. White PVA primer on left. Thin film zinc chromate primer on right.

Multicolor paints are made possible by a unique process of suspending the lacquer enamel vehicle in an aqueous stabilizing medium. This carrier solution places a protective colloidal envelope around each particle so that merging of colors is prevented. The flecks remain suspended until the coating has been applied and the colloidal solution has evaporated, allowing the aggregates to flow together as a film without merging of the flecks. It is quite evident therefore that solvents used in the vehicle must evaporate slower than water. If this were not the case, ordinary lacquer blushing would be the result. Under these circumstances even if blushing did not occur the chances of flowout to a homogeneous film would indeed be minimized.

In general, multicolor paints when applied properly, will provide a film thickness greater than that obtained from the regular run of finishing materials. Coverage or mileage then, cannot be expected to be as good with multicolors as with conventional paints. While a bit more costly initially, the additional film thickness increases their desirable physical properties which frequently leads to a more economical coating in the long run. This is manifested by increased resistance to scrubbing and scouring and improved durability. The need for repainting over relatively short periods of time is then diminished.

"Polka dot" paints have been successfully utilized on nearly every type of surface, such as plaster walls, wall board, cinder block, wallpaper, to name only a few. Its uses as well as its possibilities are infinite.

Multicolor paints can be applied in most cases as a one coat application. However, it is normally good practice and advantageous to use a good primer. By "good" primer we do not mean necessarily a high quality expensive material. Rather, what is meant is a primer which will adhere tenaciously to the substrate but at the same time provide a strong bond for a subsequent multicolor topcoat. Not all primers used in industry today will meet these specifications. Many primers, while considered excellent for the general run of industrial finishing applications, may lift or become soft and tacky in some cases, at the other extreme remain hard and prevent adhesion of the multicolor in other cases. The latter stage will, of course, produce flaking and peeling, while the former may cause the multicolor to give the appearance of non-drying or softness.

What then could be the advantages of using primers when seemingly multicolors are so sensitive in this respect? Actually, we are overemphasizing this point in order to prevent an indiscriminate choice of primer. When the manufacturers' recommendations are

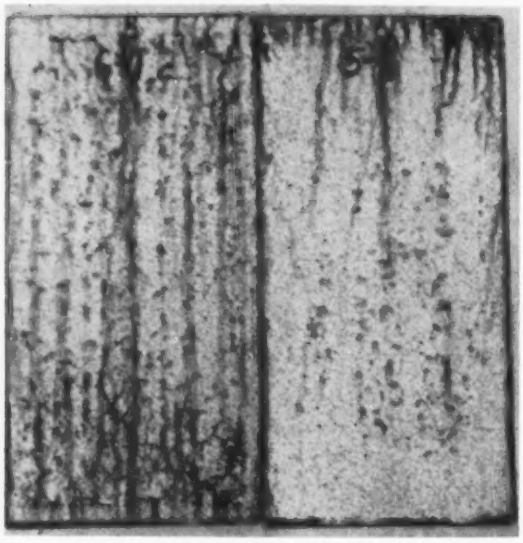


Fig. 2. Multicolor on left over PVA. Multicolor on right over thin film zinc chromate primer.

followed, failures caused by wrong primers are held to a minimum.

In normal industrial finishing operations there are many lacquers and baking enamels which produce excellent results in one coat applications. However, in the highest quality products such as automobiles, for example, primers are an important phase of the finishing system. So too, with multicolor paints are primers utilized for increased quality and performance.

On concrete or plaster surfaces, an excess of alkalinity in the substrate will, within a relatively short time, destroy the paint film regardless of whether it is multicolor or other forms of paint. In this particular instance, a primer which will tend to seal off the alkalinity present in the concrete or plaster, is actually required in order to attain maximum coating life.

On porous wood surfaces it is always good practice, and in many cases a necessity, to first apply a primer with exceptional holdout characteristics. This is true whether a lacquer, enamel, or multicolor is chosen, for the finishing material.

Steel surfaces particularly offer a challenge to the finisher. Here too, regardless of the choice of topcoat, pretreatments such as phosphating and priming are a distinct requirement under the final finish, if maximum are to be achieved.

Steel surfaces particularly offer a challenge to the finishes. Here too, regardless of the choice of topcoat, pretreatments such as phosphating and priming are a distinct requirement under the final finish, if maximum corrosion resistance and extended film life are to be achieved.

Thus in the final analysis, painting with multicolor is not substantially different than any other lacquer or enamel material where the question of using a primer is concerned. Where good practice dictates the use of a primer, it holds for all paint products including multicolor.

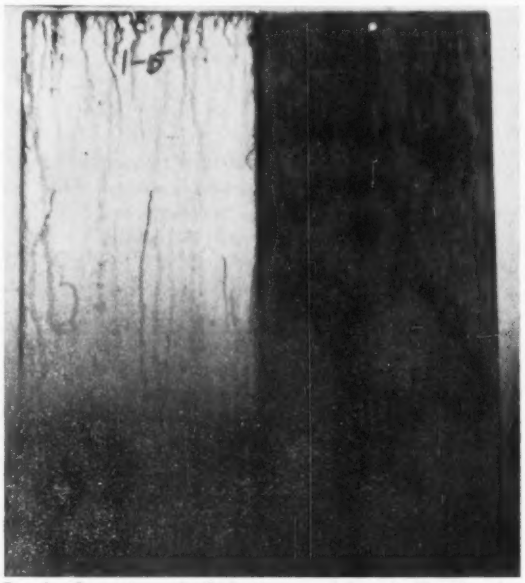


Fig. 4. Comparison of alkyd primer on left and thin film zinc chromate on right after 416 hours.

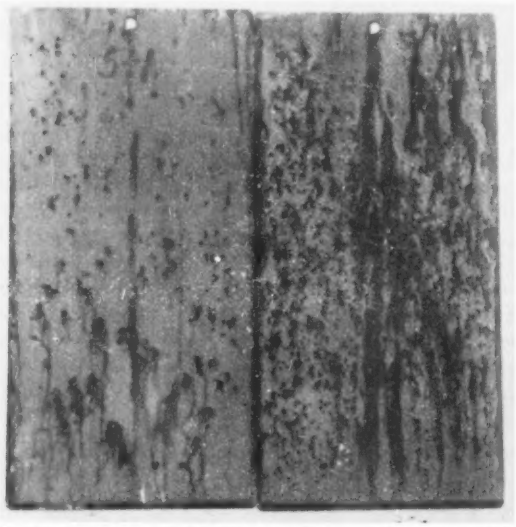


Fig. 3. Comparison of thin film zinc chromate primer on the left and heavy film zinc chromate primer on the right.

There is, however, an economic advantage present in some applications which holds true for only multicolor paints. Color flecked or polka dot enamels, as we have previously pointed out, are individual particles floating in an aqueous medium. When this solution has evaporated the particles flow together in a homogeneous film. In many cases, where a dry spray has been applied, this complete flowout may not take place leaving open areas or "holidays." Many finishers and architectural users have learned to utilize this phenomenon. These applicators purchase primers matched exactly to the background or particle in the majority of the multicolor topcoat. In spraying or rolling the multicolor in such a manner that more and larger holidays are produced, they are able to increase the mileage obtained from the multicolor enamel. With the primer matching the background color it is difficult to detect where the primer is show-

ing through. The overall color fleck or polka dot tends to give the desired pleasing textured appearance. Thus a primer with a mileage of approximately 350 quare feet will improve the mileage of a multicolor from 125 to possible approaching 200 square feet. These figures are, of course, arbitrary examples and will vary depending on the particular primer and multicolor used and method of application.

A series of tests on the values of various primers under multicolor paints were conducted recently. These consisted of outdoor exposures on wood panels and salt spray tests on phosphated steel panels. Various brands of multicolor enamels were used over the same types of primers. It was attempted to obtain objective results with no thought as to comparison of individual multicolors. The panels were prepared in the laboratory of one of the multicolor manufacturers and salt spray tested in the laboratory of an unbiased raw material supplier. Outdoor exposures were conducted in an industrial atmosphere in New Jersey and in a salt atmosphere on Long Island. Since some of the

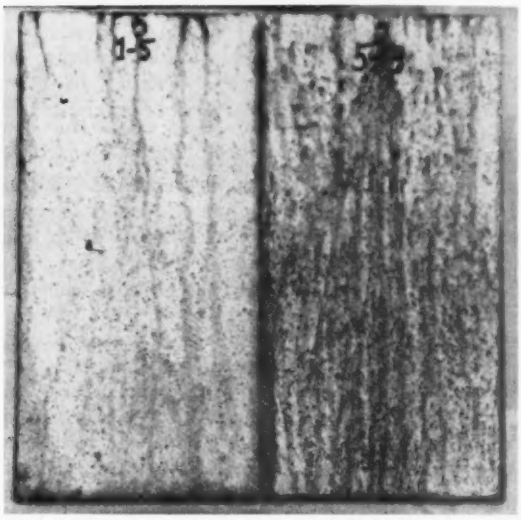


Fig. 5. The multicolor side of the panels in Fig. 4 shows the same corrosion with the alkyd on the left and the zinc chromate on the right.

multicolor paints used were not of the exterior grade, no attempt was made to evaluate the multicolors. Rather it was attempted to show that certain primers will tend to upgrade the whole finishing system.

For the salt spray tests, phosphated steel panels 6″ x 12″ were selected. Each was coated on both sides with the selected primers as purchased from various multicolor manufacturers. Five well known brands of multicolor were used for the test and five different primers utilized. However, one of the five was a zinc chromate type conforming to government specification MIL-P-6889A and it was decided to use this particular material as a thin film normally recommended and also in a heavier film buildup, the former being in range of 0.2-0.3 dry mil and the latter in the range of 2.0-2.2 dry mil thickness. All other primers were also used in the 2 mil range.

Each brand of primer was applied to five steel panels, a total of thirty-five panels in all undergoing

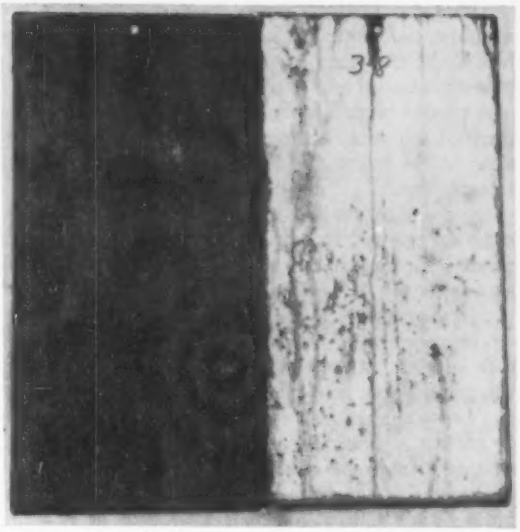


Fig. 6. Comparison of two primers at 416 hours.

test. Since all primers were proprietary, the formulation was not known other than

Primer 1—Alkyd type
Primer 2—Zinc Chromate—(Heavy Film)
Primer 3—Alkyd type
Primer 4—Alkyd type
Primer 5—Zinc Chromate (Thin film)
Primer 6—PVA type
Primer 7—Alkyd type

After application of the primer, a period of 24 hours elapsed before topcoating with the various multicolors. It was attempted to use the same mil thickness for each but because of the variances of each formulation this was not quite possible. The multicolor was applied in the minimum thickness that produced a completely covered homogeneous surface. In order to insure adequate through dry, a period of two weeks was allowed before submitting the panels for salt spray evaluation.

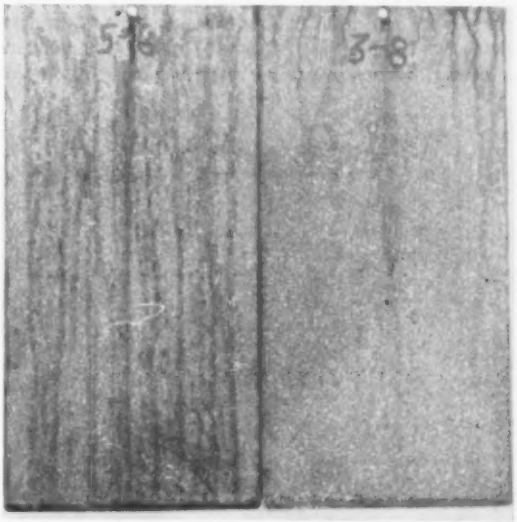


Fig. 7. Comparison of the same brand of multicolor over the two different brands of primer (416 hours).

The same procedure was used in preparing the wood panels for outdoor exposure except that Primers 5 & 6, the zinc chromate type were eliminated. Each panel was sealed and sanded prior to priming.

A caution should be interjected at this point on the merit of salt spray testing. Because of the wide variations in the manner of salt spray techniques, no inference should be drawn as to their relative merit compared with outdoor salt atmospheres. In fact, the same apparatus has been seen to give divergence in results from one time to the next. It can only be used as one means of comparison if all panels are tested within the same cycle at the same time.

The panels were checked periodically for rust and deterioration. At the end of 292 hours the multicolors which had been applied over the PVA type primer and heavy film of zinc chromate, showed severe signs of rusting and were removed from the salt cabinet. At this point some of those panels over the 0.3 mil thickness zinc chromate began to show some signs of failure and were also removed. Fig. 1 shows the primer appearance of the PVA and the thin film of zinc chromate primer. Fig. 2 shows the multicolor side over the primers in Fig. 1. It can be noted that the deterioration of the primer itself on all panels was proportional to the amount of rusting on the topcoated side. Fig. 3 shows the relative deterioration of the thin film of zinc chromate on the left and the heavier film on the right.

Some of the thin film zinc chromate primed surfaces were continued until 416 hours had elapsed. At this stage all tests were concluded. The alkyd type primers appear to withstand salt spray testing to a much higher degree than any other form of primer. Fig. 4 shows a comparison of an alkyd primer and a zinc chromate primer (0.2 mil) at the end of 416 hours. The alkyd on the left exhibits much less corrosion than the zinc chromate on the right. Fig. 5 shows the same comparative effect with the same brand of multicolor. Using the same primer but changing the brand of multicolor as in Figs. 6 and 7 show that the system varies as the primer. There was, however, one particular alkyd brand primer and multicolor system which exhibited a superior resistance to salt spray tests. Fig. 8 shows both panels on the primer side containing little signs of rusting; Fig. 9 shows the topcoated side also having slight amounts of corrosion after 416 hours.

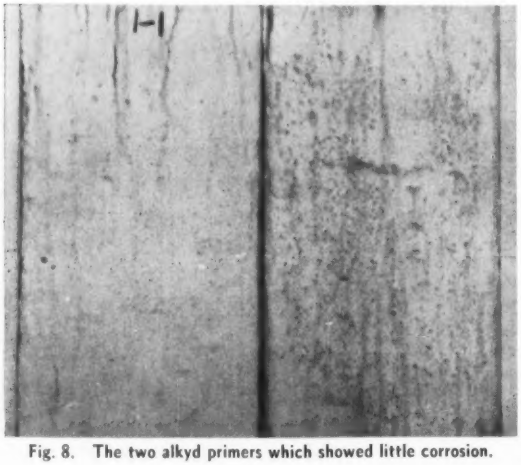


Fig. 8. The two alkyd primers which showed little corrosion.

Fig. 9. The multicolor over the two primers in Fig. 8. This system withstood the 416 hours. The best of all panels tested.

The outdoor exposure tests conducted on multicolor-primer systems also showed some very interesting results. In recent months the theory had been propounded that incomplete multicolor coverage over a primer allows free passage of moisture ("breathing") and therefore produces durable coating systems. On the basis of the above exterior exposure test, however, it would appear that this theory has been refuted and has no basis in fact.

The exterior exposure tests were conducted on both outdoor wood shingles and asbestos or gypsum siding. The same primers were used in these tests as were used for salt spray with the exception that the zinc chromates which were eliminated.

As was mentioned previously, the results obtained in salt spray do not necessarily agree with outdoor exposures. Such is the specific instance of P.V.A. primers which deteriorate rather badly in salt spray but produce superior results on exterior durability.

On the basis of the results obtained by both testing media, it is quite obvious that commercially acceptable methods of priming enhance the life expectancy of multicolor systems. Where the primer has failed, so too will the multicolor top coat. Of course, one may note that on outdoor exposure two seal coats of multicolor proved superior in many cases to a primer system. This is true, but from a practical economic standpoint few people desire this approach. However, should that be the chosen method, improved durability could be expected.

It has often been said that a chain is only as strong as its weakest link. Surface preparation or priming can be the weak link in the finishing system. Inferior or improper preparation or prime coating can and will detract from the performance of multicolor paints. On the interior surfaces which are not nearly as critical, this may not be apparent; in fact, the results are quite pleasing, with wearability and washability extremely good. Exterior surfaces require more care in preparation of surface and selection of primer. The application is also an essential factor. If all the factors involved are viewed in their true perspective and normal precautions exercised, there is no reason why exterior grade multicolor paints will not provide a strong durable, beautiful and satisfying surface coating.

FINISHING POINTERS

Plating Time Determinations

By Edward F. Duffek
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ELECTROPLATING metals to precise thicknesses has become very important in recent years. Methods for calculating the exact thickness and the plating time must include the cathode current efficiency.

General equations which consider the current efficiency may be derived which establish the plating time needed to obtain a required thickness or weight of plating. The use of these equations eliminates repetitive calculations, especially where production processes are concerned. Two techniques frequently used are the "Test Panel" and the "Copper Coulometer."

Test Panel Method

The usual procedure to determine the time required to obtain a desired thickness of metal is to electroplate a test panel of known weight and area under defined conditions of current density and time. The weight per unit area may be determined by the following equation:

T = time to plate Ymg./in.^{2} at I_2 amp./ft.^{2} =

$$\frac{Y \times 144}{I_2}\left(\frac{t \times i_1}{\text{wt. of panel deposit}}\right)$$

where

Y = required weight of metal in mg./in.^{2}
I_2 = current density in amp./ft.^{2}
t = time in minutes used in preparing test panel
i_1 = current in amperes used in preparing test panel, and also equal to I_2 times the panel area

Example:

An indium plating solution gave 200 mg. of indium on a test panel of 12 in.^{2} when plated at 1.67 amperes for 10 minutes. Required time to deposit 6 mg./in.^{2} at the above current density (amp./ft.^{2}):

$$T = \frac{6 \times 144}{20}\left[\frac{10 \times 1.67}{200}\right] = 3.61 \text{ minutes}$$

The above equation can also be expressed in oz./ft.^{2}; as for example:
time to deposit 0.0746 oz./ft.^{2} (0.0001″) of copper at 20 amp./ft.^{2} =

$$\frac{0.0746}{20}\left(\frac{t \times i_1}{\text{wt. of panel deposit}}\right)$$

The common electroplated metals and their weights per unit area for 0.0001″ are given in the table.

Copper Coulometer Method

This procedure can be used for estimating the thickness of electrodeposits. The general equation, with the cathode current efficiency considered, is:

$$\%\text{ cathode current efficiency} = \frac{\text{wt. M}}{\text{wt. Cu.}} \times \left(\frac{Z_M \times 31.77}{\text{(at. wt. M)}}\right) \times 100$$

where:

wt. M = weight of metal deposited on a test specimen from the solution under consideration
Z_M = valence (electron change) of the metal, M.
at. wt. M = atomic weight of the metal, M.
wt. Cu. = weight of copper deposit obtained from the copper coulometer

Example:

$$\text{Nickel, \% cathode efficiency} = \frac{\text{wt. Ni.}}{\text{wt. Cu.}} \times \left(\frac{63.54}{58.7}\right) \times 100$$

$$\text{Silver, \% cathode efficiency} = \frac{\text{wt. Ag.}}{\text{wt. Cu.}} \times \left(\frac{31.77}{107.9}\right) \times 100$$

$$\text{Copper (cyanide), \% cathode efficiency} = \frac{\text{wt. Cu.}}{\text{wt. Cu. (coul.)}} \times \left(\frac{31.77}{63.54}\right) \times 100$$

Here the copper coulometer must be operated under the proper conditions since the current efficiency is assumed to be 100%. The true plating thickness for a given time may then be estimated by multiplying the cathode efficiency and the theoretical plating thickness obtained from the nomograph given in the METAL FINISHING GUIDEBOOK (p. 671, 1959 Edition). Conversely, the true plating time may be obtained by dividing the theoretical plating time by the cathode efficiency.

TABLE I

Element	*oz./ft.^{2} for 0.0001″**	*mg./in.^{2} for 0.0001″***
Cd	0.0716	14.1
Cr	0.059	11.6
Cu	0.0746	14.7
Au	0.147 (troy oz.)	31.8
In	0.056 (troy oz.)	12.1
Fe	0.0655	12.4
Pb	0.0945	18.6
Ni	0.0741	14.6
Pd	0.091 (troy oz.)	19.7
Ag	0.0796 (troy oz.)	17.2
Sn	0.0608	12.0
Zn	0.0594	11.7

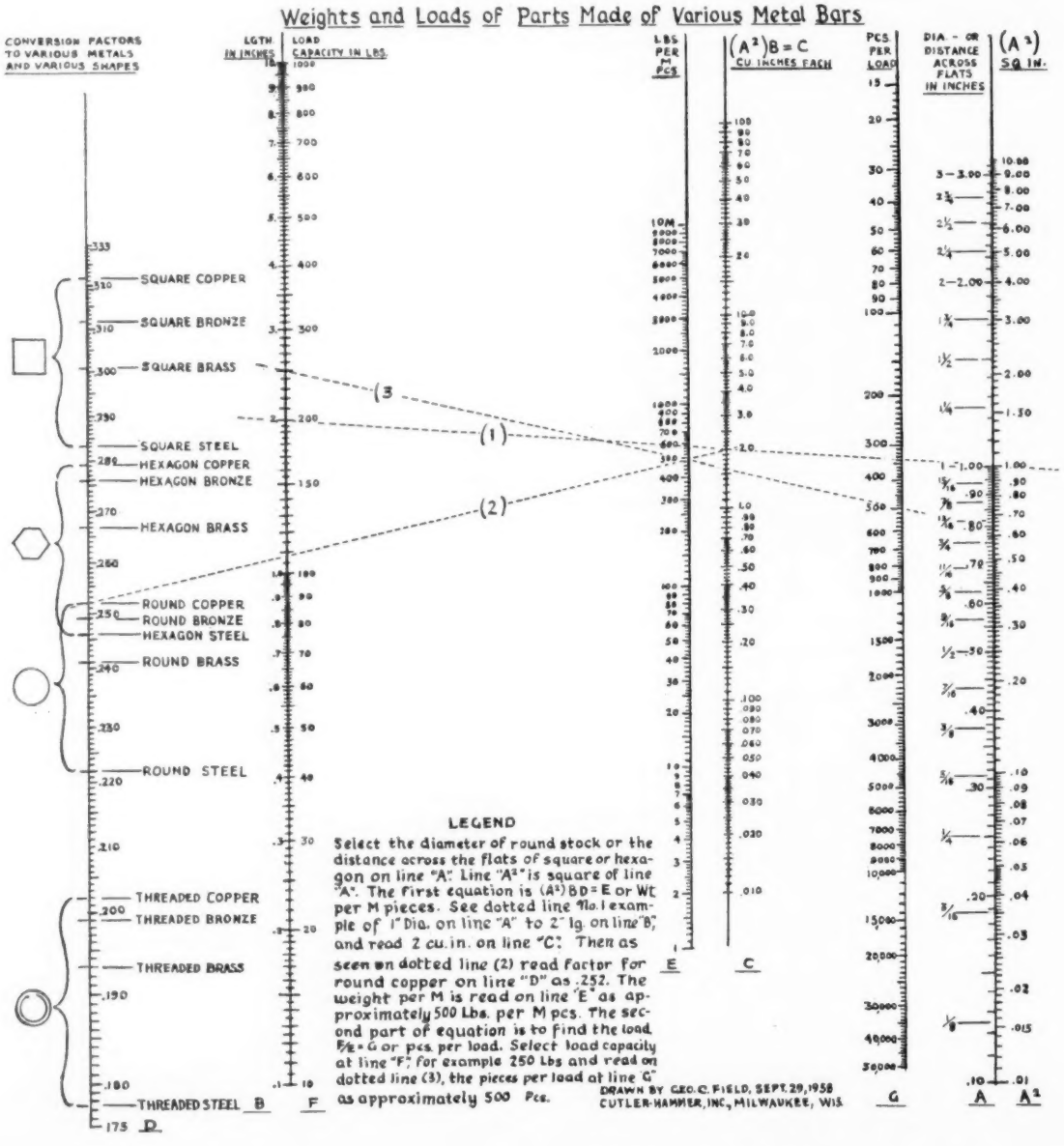
*The oz./ft.^{2} for 0.0001″ is obtained by multiplying the density of the metal by 0.00833 and 0.00759 for avoir. and troy oz. respectively.

**The mg./in.^{2} for 0.0001″ is obtained by multiplying the oz./ft.^{2} by 196.9 and 216 for avoir. and troy oz. respectively.

Weights and Loads of Parts Made of Various Metal Bars

By George Clayton Field, *Cutler-Hammer, Inc., Milwaukee, Wisc.*

THIS nomograph was developed to meet a need for flexibility and wide scope for determining loads for finishing. This includes all forms of tumbling, dipping, and bulk plating. Of course, the use of the chart has to be limited to parts and purposes that do not require hair-line accuracy. This chart uses some of the features of one published in METAL FINISHING in March 1958, entitled "Measuring Loads Of Solid



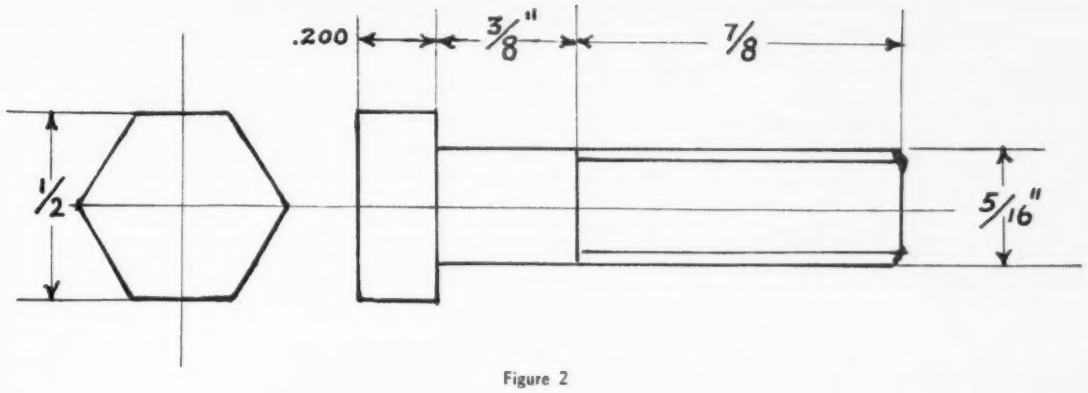


Figure 2

Flat Steel Parts." The new chart shown here, covers a wider variety of applications, such as hexagon and square head screws; round, hexagon, and square pins; tubes and washers; nuts and studs.

Using the Chart

Line (A) is for selecting the diameter or distance across the flats of the part to be calculated. In constructing the chart this dimension was squared as shown on the right side of this line (A) as (A^2). Next, observe the (B) scale which is captioned *Length In Inches.* By laying the straight edge across from the selected point on line (A) to the desired length on line (B) one may read the cubic inches of the part as if it were square, on line (C). The next step is to adjust to the shape of the bar and the kind of metal. This is done by laying the straight edge from the point on line (C) to the shape and kind of material on line (D). One may read the pounds per 1000 pieces on line (E). Next select the size of the load which is to be put in a barrel or basket on line (F); move the left end of the straight edge to that point, and read the number of pieces per load on the (G) scale.

It may be desired to estimate the weight and load of a hexagon steel screw as seen in the figure. To do this it must be calculated in sections—head, body, and threaded portion. First the distance across the flats for the head is selected on line (A) as ½" and then the thickness of the head is taken as the length of 0.200" on line (B). The cubic inches are read on line (C) as 0.050 cu.in. Holding the pencil on the line at this point; swing the straight edge around to hexagon steel on line (D) and read 12½ lbs. per M on line (E). Jot this amount down and take the next portion, the body as seen in the figure which is $\frac{5}{16}$" dia. x ⅜" long. Repeat the above process but select the round steel instead of hexagon on conversion line (D) and read 8½ lbs. on line (E). This figure is also recorded. For the threaded portion, select $\frac{5}{16}$" as the diameter on line (A) and by holding a pencil at 0.085 cu. in. on line (C) swing the ruler and read 15 lbs. on line (E). Again, record this figure, which, added to the others (12.5 + 8.5 + 15.0) gives a total of 36 lbs., the approximate weight of 1000 hexagon head screws.

Now, if one is using a 175 load capacity for plating in a barrel, select 36 lbs. on line (F) and read 5200 pieces per load on line (G).

For calculating the weight of round brass tubes, first select the outside diameter on line (A) and length on line (B) and read the cu. in. each on line (C), then swing the ruler to round brass on line (D) and read the lbs. per M on line (E) as if the piece were solid. Then select the inside diameter on line (A) and repeat the above operation, subtracting the estimated weight of the inside diameter reading from the outside diameter reading. The remainder will be the lbs. per M pieces of the round brass tubes.

The thread portion of the conversion line (D) was constructed by taking an average percentage of solid round material. This is because the size of the thread is usually proportionate to the diameter of the piece. This, then applies to the common sizes of thread, such as ¼-20, $\frac{5}{16}$-18, ⅜-16, ½-13 and so on.

When using this nomograph, be sure to select diameters across flats on the (A) scale and not on the (A^2) scale. When reading all scales, exercise care so as to obtain accuracy. It must be remembered that, in order to obtain greater scope and flexibility in a chart of this size, it cannot be hoped to obtain vernier readings. However, with care, this chart will prove satisfactory for the purpose for which it is constructed.

BULK BRIGHT DIPPING

(*Continued from page 72*)

All fumes are exhausted to the outer air from a totally enclosed machine. In the hand-dipping process, the operator could not help but inhale some of the noxious acid fumes even though exhaust hoods were provided to carry away the fumes. Third, the actual dipping process was simplified, e.g., pickling of the bases prior to bright dip was found to be no longer essential when the operation was made automatic. Fourth, the various solutions have been more closely and carefully controlled-automatically. And, this has made for a much greater uniformity in appearance of the bright dipped parts. Finally, and from a management viewpoint a very important result, the cost of bright dipping has been reduced greatly even though rates of pay have risen rapidly.

Electropolishing of Aluminum, Review and Literature Survey 1946 to 1958

By Dr. Anton F. Mohrnheim, *Division of Engineering Research and Development, University of Rhode Island*

A LARGE number of the electropolishing processes used today are of a proprietary nature and covered by patents. The research chemist and the metal finishing engineer are confronted with the task of employing or developing improved production methods that will best serve the everpresent need and the increasing demand for better and more economical processes. In order to accomplish this, points of reference are required that will provide the basis for their developments. It is with this idea in mind that the following compilation of literature abstracts and patents on electropolishing of aluminum and its alloys has been undertaken.

Chas. L. Faust wrote, in 1946, a historic summary on electropolishing and *P. A. Jacquet* presented, in 1947, a review with 161 references. To avoid repetition, this survey begins with 1946. It is based on *Chemical Abstracts* to which credit is due. No references to chemical polishing of aluminum are given in this article. 108 references are numbered within the year of publication or patents granted, alphabetically by the author, the inventor or patent holder, respectively.

It may be of general interest to compare the world wide activity in the field of electropolishing of aluminum by noting the origins of the publications and patents that are included in this survey as shown in the following table:

Publications on Electropolishing of Al, 1946-1958

American	25 (17 Patents)	
English	18	(3 Books)
French	10 (3 Patents)	
German	19 (6 Patents)	(1 Book)
Japan	19 (16 Patents)	
USSR	5 (1 Patent)	
Others	12 (5 Patents)	
Total	108 (48 Patents)	(4 Books)

1946

"Electropolishing — What is its Status Today?" **Faust, C. L. Proc. Am. Electropl. Soc.,** *33,* 49-73 (1946).

A historic summary, list of patents issued through 1945, and a discussion of commercial application of electropolishing. A bath containing H_2SO_4, H_3PO_4, and CrO_3 used at 11-16 amp./dm^2 and 90-95° will electropolish Al alloys. Careful control of viscosity and density is required due to the tendency of Al to anodize. Equipment required and costs are discussed."

"Electropolishing in Postwar Finishing." **Faust, C. L. Metal Progress,** *50,* 1068-1069 (1946).

"Finishes for Aluminum." **Petitt, R. E. Product Eng.** *17,* 11 (1946).

Mechanical, chemical, organic, and electrolytic treatments. Methods of polishing, etching, and finishing.

1947

"The Possibility and Limitations of Electrolytic Polishing of Metals." **Brockington, A. F. Sheet Metal Ind.,** *24,* 1414-1416 (1947).

"Note on Convenient Method of Electropolishing Al Alloys." **Evans, U. R., and Whitham, D. J. Electrodepositors' Tech. Soc.** *22,* 24-28 (1947).

EtOH, 144 ml; $AlCl_3$, 10 g; $ZnCl_2$, 45 g; H_2O, 32 ml; N-butanol, 16 ml; at 20-24 volts and c.d. about 10 amp./dm^2. Operation involves intermittent withdrawal of anode from bath. Each cycle requires about 1 minute.

"Electropolishing." **Fischer, J. Metalloberflaeche** *1,* 81-83 (1947).

A review.

"The Principles and Scientific Applications of the Electrolytic Polishing of Metals." **Jacquet, P. A. Sheet Metal Ind.,** *24,* 2015-2025, 2030 (1947).

Review; 161 references.

"Glycerol in Electrolytic Treatment of Aluminum and its Alloys." **Leffingwell, G., and Lesser, M. A. Products Finishing,** *12,* 2, 36, 38, 40, 42, 44, 46 (1947).

A review; 22 references.

"Electrolytic Polishing." **Pray, Holden Electroplating,** *1,* 22-24 (1947).

A general discussion.

"Electrolytic Bright Polishing." **White, H. I. (to American Rolling Mill Co.). U. S. Pat. 2,424,674 (1947).**

Anodic polishing in a bath of 85° phos-

phoric acid diluted with 10-50 parts butanol, c.d. 0.5-5-amp./in.^{2}, 1-2 min., temp. 50-70°. (acid should be low in F).

1948

"Electropolishing of Aluminum and its Alloys." **AGMA Aktiengesellschaft. Swiss Pat. 256,850 (1948).**

An alkaline phosphate or fluosilicate is used for the electropolishing of aluminum and its alloys; the anions act as current regulators and reduce the necessity of changing the electrolyte. Na_2CO_3-20%, Na-fluosilicate —7%, and Na_3PO_4 —2%. c.d. of 2 amp./dm.^{2} and 13 volts at 85°. Reflectivity 87%.

"Thickness Growth and its Limitations of Anodized Coatings on Aluminum." **Elssner, G. and Beyer, A. Arch. Metallkunde, *2*, 120-130 (1948).**

The effect of the bath on the protective layer limits its thickness. The layer may be redissolved, whereby its thickness is decreased and structure destroyed. Inside of the small pores the layer thickness is much smaller than outside surfaces. Surface hardness is independent of pore size.

"Procedure for the Study of Electropolishing." **Epelboin, I. and Chalin, C. Compt. Rend., *226*, 324-326 (1948).**

Optimum conditions are found by plotting (V-e)/I vs. V, where e is the back e.m.f. of the cell (obtained by plotting I as a function of V and extrapolating to O). The best conditions are the max. of this curve. Since e is usually very small compared to V it may be neglected and, thus, optimum is at V/I vs. V. Method lends itself to manual or automatic control.

"Surface Preparation by Electropolishing." **Faust, C. L. Pittsburgh Int. Conf. on Surface Reactions, 187-195 (1948).**

Essentially a detailed review and discussion of the literature concerning electropolishing since 1936: methods, physical and chemical properties of surfaces obtained; importance of studying microstructures, electrochemical potentials; and corrosion studies.

"Industrial Electropolishing." **Faust, C. L., and Graves, E. E. Proc. Am. Electroplaters' Soc. *35*, 223-239 (1948).**

Fine grain size is essential to good electropolishing. Recent patents are given; 24 references.

"Use of Rotating Anode in the Electropolishing of Cd and Al." **Farran, J. Metaux et Corrosion, *23*, 9-11 (1948).**

A 6 mm diameter anode, rotating at 100 rpm, greatly increased the polishing over still polishing of Al.

"Electrolytic Polishing of Aluminum and its Alloys, with Simultaneous Formation of a Protective Layer of Al_2O_3 of High Transparency and Resistance." **Sasetti, A., and Sonnino, C. Ital Pat. 433,-487 (April 1948).**

Bath: NaOH, 1-20%; H_3PO_4; 1-10%; CrO_3, 1-8%; temp. 60-95°, 10-20 v., c.d. 5-8 amp./dm.^{2} Start without current for a few seconds, then with current for 6-10 min., wash, treat with an acid solution at room temp., wash.

"Electropolishing, A Survey." **Wein, S. Metal Finishing, *46*, 2, 71-77 (1948).**

A survey, 57 references.

"Electropolishing, A Survey." **Wein, S. Metal Finishing, *46*, 4, 76-82 (1948).**

Applications and limitation of processes and baths are discussed. Baths considered are: $HClO_4$, H_3PO_4—CrO_3, H_2SO_4—H_3PO_4, H_2SO_4-citric acid, H_3PO_4 complexes, fluoride, arsenic acid. Metals considered, C.I., C and alloy steels, wrought and cast Fe, Cu, brass, Monel and Ni-Ag, Al, Zn, Cd, Ag, Pb, Sn, Pb-Sn alloys, Mg. Costs are discussed. 66 references.

1949

"Electrolytic Polishing of Metals." **Compagnie de Produits Chimiques et Electrometallurgiques Alais, Froges, and Camargue. French Pat. 941,238 (Jan. 1949).**

An electrolytic bath for anodic polishing of metals, especially Al and Al-alloys, consists of 250 cc water, 750 cc phosphoric acid, 300 g oxalic acid, 150 g H_3BO_3, and 1 g litharge. Treatment is carried out for several min. with agitation at 60° and with c.d. of 30 amp./dm.^{2}

"Electrolytic Polishing." **Dettner, H. W., and Arend, H. Eisen & Metall-Verarb., *1*, 416-418 (1949).**

A review with bibliography. Extensive tables are included which report such data as composition of the bath, c.d., bath temp. and polishing time for various metals and alloys.

"Electrolytic Polishing of Al and its Alloys by Use of an Electrolyte of Sulfuric and Citric Acids." **Hine, F. Japan Pat. 178,514 (Apr. 1949).**

"Electropolishing by Alternating Current; II. Aluminum." **Hine, F. J. Electrochem. Soc. Jap., *17*, 52-53 (1949).**

Electropolishing of Al by a.c. was studied. Electrolyte: conc. H_2SO_4—50 cc, citric acid —35 g, H_2O—45 cc; cathodes of steel, Fe, Ni, Pb, or C (Pb most effective); optimum temp. 50-70°; low purity Al gave better results than high purity Al.

"Electrolytic Polishing of Metal Surfaces." **Koncz, I. Aluminium (Budapest), *1*, 51-57, 74, 78 (1949).**

A review of electrolytic polishing of metal surfaces with 151 references.

"Electrolytic Polishing of Metals." **Miyoshi, I. (to Mitsubishi Heavy Ind. Co.). Japan Pat. 180765 (Oct. 1949).**

Electrolyte: 100 ml H_3PO_4 (d. 1.2-1.8); 1-10 g tartaric acid; 1-10 g gelatin; Pb cathode.

"Electrolytic Polishing of Metalic Surfaces." **Jacquet, P. A. Metal Finishing, *47*, # 5, 48-54; #6, 86-92 (1949).**

Phenomena accompanying the electropolishing of metals are explained. Preparation of samples, electrolytes used, conditions, arrangements and form of electrodes, time, temp. and treatment after polishing are discussed; extensive bibliography.

"Electropolishing I. Polishing with A. C." **Moto, K. Prpr. Osaka P.J.R.I. *1*, 12-20, 21-25 (1949).**

The advantages of electropolishing C steel, Al, and Ni with 60 cycle a.c. are: current easily available, 2 metals can be polished simultaneously, stable current flow. Influence of the viscosity, temp. and stirring of electrolyte. In electropolishing Cu in H_3PO_4 with or without glycerol, the c.d. (taken as the current in the amp.-volt curve just before O_2 was generated) was related hyperbolically to the viscosity, varying with conc. of H_3PO_4 and temp.; stirring shortened polishing time.

"Electrolytic Brightening of Aluminum." **Tosterud, M. (to Al. Co. of Am.), Can. Pat. 461, 222 (Nov. 1949).**

Electrolyte: Na_2CO_3, 10-20; Na_3PO_4, 3-7; Na-octyl sulfate, 0.01-0.1%.

1950

"A Method for the Electrolytic Polishing and Etching of Some Al-Ag Alloys, Commercial Pure Al and Mg." **Larke, L. W. and Wicks, E. B. Metallurgia *41*, 172-174 (1950).**

Alloys with 0.5, 2.0, 4.0, 8.0% Ag Electrolyte: 400 cc. H_3PO_4 (sp. gr. 1.25); rinse in alcohol prior to immersion into electrolyte, stirring, c.d. 3.5 amp./dm.^{2}, 27-30/volts, satisfactory polish free of pitting, time 4-6 min., temp. 42-45° C.

"Electrolytic Polishing of Metals in Electrolytes Treated with Electric Waves of High Frequency." **Kunio, M. and Nagai, K. Japan Pat. 321 (Feb. 1950).**

The electrolyte is treated with static or electromagnetic energy, and then the metal as the anode is polished by electrolysis.

"Electrolytic Polishing of Metal Surfaces." **Miyoshi, I., et al (to Mitsubishi Heavy Industries Co.). Japan Pat. (Feb. 1950).**

The metal is electrolytically polished in H_3PO_4 with chlorides, such as HCl, $FeCl_3$ or NaCl.

"Electrolytic Polishing of Metal Surfaces." **Izumi, M. and Kitano, I. (to Central Japanese Heavy Ind. Co.) Japan Pat. 3461-2 (Oct. 1950).**

The surface to be polished is electrolyzed in a solution of H_3PO_4, and/or H_2SO_4 containing an aldehyde, such as HCHO, AcH, or furfurol, with a.c. or d.c. Electrolyte composed of H_3PO_4 (d>1.4), HNO_3 and/or nitrates, used for electrolytic polishing of high C-steel, Fe, Ni, Cr, Al, Cu or their alloys.

"Electropolishing of Metals." **Naritoku, N. and Washio, K. Japan Pat. 3866 (Nov. 1950).**

Metals are electropolished by using an electrolyte containing anhydrous high purity acetic acid with a variable amount of H_3PO_4 and a viscosity-increasing substance.

"The Electrolytic Polishing Process II." Piontelli, R. Met. Ital. *42*, 205-224 (1950).

Concepts: leveling power, microsmoothing power, brilliancy action, selective attack. Conclusions based on polarization phenomena are applied to the theory.

"Electrolytic Polishing of Metals." **Teruo, Y. (to Togoda Automobile Ind. Co.). Japan Pat. 1264 (Apr. 1950).**

The electrolyte containing 30 g zinc is dissolved in 1 liter H_3PO_4 (d. 1.6) to make a smooth and shining polished surface.

1951

"Anodically Polishing Al." **Faust, C. L. (to Battelle Devel. Corp.). U.S. Pat. 2,550,544 (Apr. 1951).**

Electrolyte: H_2SO_4, 4-45%; H_3PO_4, 40-80%; CrO_3, 0.2-sat.; dissolved Al and Cr, 0-6%; c.d. 60-150 amp./ft.^{2}, temp. 160-200°F, 7-15v.

"Electropolishing." **Kohn, M. Austrian Pat. 168,663 (July 1951).**

Electropolishing or brightening of metals is carried out with a.c. of any frequency and number of phases. In alkaline solutions rH must be below 20.5, in acid above 20.5. Several samples of electrolyte compositions and suitable working conditions are given.

"Electrolytically Polishing Al and its Alloys." **Patrie, J. (to Compagnie de produits chimique et electrometallurgiques Alais). U.S. Pat. 2,553,937 (May 1951).**

Bath: aqueous solution of acid or mixed acids, HNO_3, 30-45%; H_3PO_4, 8-24%; H_2CrO_4, 3-10%; Temp. below 20°, c.d. 90-450 amp./ft.^{2}, time 1-10 min.

"Electrolytic Polishing of Al or its Alloys." **Toyoyoshi, S. Japan Pat. 262 (Jan. 1951).**

Solution: >50% H_3PO_4; 5-10% H_2SO_4; 3-5% fluoride; 2-5% MeOH; Cathode: Pb or stainless steel; c.d. 20-80 amp./mm.^{2}, 4-20 volts.

"Finishing the Surface of Aluminum Articles." **Siemens & Halske A. G. (H. Fischer, inventor). German Pat. 828,466 (Jan. 1952).**

The articles of Al (or Al alloy) to be treated are, after degreasing, dipped for 10-60 sec. (preferably 30 sec.) in an aqueous alkaline bath at 60-130° and then rinsed with hot and cold water. A suitable bath is prepared by mixing 240 g NaOH with 180 g water. The Al articles have a bright and lustrous surface, free from drawing grooves and scratches.

"Electrolytic Polishing of Metals." **Societe industrielle de fournitoures pour l'electrolyse. French Pat. 992,627 (Oct. 1951).**

Temp. 130°, 3-25 v., 2-50 amp./dm^2 in a 3 component polishing bath, containing: metal-attacking compound, H_2SO_4 33%; complex forming compound, H_3PO_4 23%; thickening agent, citric acid—26%; H_2O—15%; Al—3%.

"Electrolytic Polishing of Al." **Shinichi, T., et al. (to Scient. Res. Ind. Ltd.). Japan Pat. 855 (Feb. 1951).**

Electrolyte: H_3PO_4, $H_4P_2O_7$, HPO_3 and a substance which has no direct dissolving action on the metal, e.g. $C_3H_5(OH)_3$; a.c.

"Anodic Brightening & Polishing of Articles of Al or Al-alloys." **Vereinigte Deutsche Metallwerke A. G. (Hans Burkhardt, invent.) German Pat. 825,937 (1951).**

Brightening or polishing of Al articles is effected by using them as anode in an electrolyte containing one or several arylsulfonic acids besides inorganic acids, at temp. above 50°, pref. 65-100°. A suitable electrolyte is composed of 55-75% H_2SO_4, 5-25% benzenesulfonic acid, and the rest H_2O; or 40-60% H_2SO_4, 5-25% benzenesulfonic acid, 5-35% H_3PO_4, and the balance water.

"Electrolytic Polishing and Bright Plating of Metals." **Wernick, S. Alvin Redman, London, 2nd Ed., 243 pp. 1951.**

1952

"Electrolytic Oxidation of Al." **Balmas-Salomon, M. French Pat. 1,009,359 (May 1952).**

Al and its alloys are treated in a bath of pH 5.8-6.5, consisting of an organic acid, preferably oxalic acid, and one or more inorganic acids, e.g. H_3PO_4 and/or chromic. Conditions: slightly elevated temp., c.d. 0.5-0.8 amp./dm.^{2} with voltage of 20-30, and 2-4 amp./dm.^{2} with voltage of 110.

"An Improved Cell for Electrolytic Polishing." **Gleekman, L. W., Evans, G. E., and Grove, C. S., Jr. Metal Progress,** *61*, #6, 92-93 (1952).

Description of equipment which can be used up to 160°F. with many acid electrolytes, but most $HClO_4$.

"Measuring and Photographing the Surface of Anodically and Chemically Polished Pure Aluminum." **Heilling, W. and Baumann, F. Metall,** *6*, 346-350 (1952).

To determine the degree of polish and anodic and chemical polishing methods, the purest Al-surfaces are photographed by ordinary microscopic methods, by electron microscopic methods, as well as measuring the direction of reflection by the Elze and Gruss brightness mirror. These methods give a good picture of the changes in surface procedure by anodic and chemical polishing.

"Electrolytic Polishing of Al and its Alloys." **Takesaburo, I. and Boshin Ro. Japan Pat. 4555 (Nov. 1952).**

Conc. H_3PO_4 satd. with $K_2Cr_2O_7$ is diluted with 10-50% by vol. H_2O, to which <10% by wt. of potassium caluminate, $FeSO_4$, and/or $Fe_3(PO_4)_2$ is added.

"A Method for the Investigation of Electroplating Problems." **Lorking, K. F. Australasian Engr., 58-61 (Feb. 1952).**

"Oxanal Salt in the Processing of Al and its Alloys." **Wittwer, R. Ciba Rev., #92, 3329 (1952).**

The use of Oxanal salt in anodic electrolytic polishing and in dyeing process, insures more level results. It is nonionic compound, possessing specific dispersing properties. It is stable to acids and various electrolytes. Optimum amounts are suggested for anodic oxidation, electrolytic polishing and dyeing.

1953

"Electrolytisches Polieren der Metalle in der Industrie." **Benninghoff, H. Saulgau, Ger.: Eugen G. Lenze, 1953, 146 pp.**

"The Present State of Electrolytic and Chemical Polishing." **Dettner, H. W. Metall, 7, 325-328 (1953).**

"Polishing of Al Mirrors." **Hayasaka, K. Japan Pat. 1254 (Mar. 1953).**

A mirror of 99.9% Al is made the anode in an electrolyte containing equal volumes of 96% AcOH and H_3PO_4 (d. 1.840). The solution is electrolyzed at 50-80°, 1-2 v, 3-6 amp./dm.^{2} for 5-15 min. to give mirror surface with 90% reflection.

"Polishing Al." **Hesch, F. H. (to Kaiser Al. & Chem. Corp.). U.S. Pat. 2,640,806 (June 1953).**

Al and its alloys are electrolytically brightened by etching in an aqueous solution at 100-190°F. HNO_3, 0.5-6.0%; HF 0.01-0.5%; glycerol, 0.5-5.0%; Pt or Au electrodes; use graphite lined vessel.

"Electrolytic Purification of Anodic Polishing Baths." **Muehlberger, H. Ger. Pat. 879,636 (June 1953).**

Removal of dissolved anode matter by inserting electrode, which is kept at a lower potential than the decomposition potential of the anode metal.

"Electropolishing and its Applications." **Naylor, C. E. Electroplating,** *6*, 15-17 (1953).

A review; operating conditions of 19 bath compositions for stainless steel, 70-30 brass, Al, steel, Cu-Ni alloys, Cu, Zn, Ni.

"Theory and Practice of Chemical Polishing. II Processes for Light Alloys, Iron Group and Other Metals." **Pinner, R. Electroplating,** *6*, 401-410 (1953).

A comprehensive listing of the most commonly used formulations, together with discussion of performance; 41 references.

"Theory of Electrolytic Polishing." **Pinner, R. Electroplating and Metal Finishing,** *6*, 444-450 (1953).

A review; 29 references.

"Electropolishing of Al and its Alloys." **Yuichiro, S. Japan Pat. 4909 (Sept. 1953).**

Al or Al-alloys are polished in an electrolyte of 100 parts H_3PO_4 (d. 1.62), 10 parts CrO_3; temp. 50° for 30 sec., at 5-8 amp./dm.^{2}

"Effect of Shape and Position of the Work in the Electrolyte on the Quality of Electrolyte Polishing at Low Current Density." **Tarzimanov, D. A. Trudy Kazan. Khmim.-Jekhnol. Inst., #17, 109-118 (1953).**

The shape and the position of the anode in the electrolyte greatly affected the quality of the electropolishing. Best results when anode is set at an angle of 30-40° to the horizontal.

"Surface Treatment and Finishing of Light Metals VIII." **Wernick, S. and Pinner, R. Sheet Met. Ind.,** *30,* **571-583 (1953).**

A review of electrolytic and chem. polishing processes; 50 references.

"Electrolytic Polishing of Metals." **Yamaguchi, Y. and Furukawa, T. (to Toyada Physico-Chemical Research Inst., Inc.). Japan Pat., 656 (Feb. 1953).**

Alkali polysulfide is used as electrolyte.

1954

"Electropol. of Aluminum." **Dhingra, D. R., Gupta, M. G. and Joshi, G. J. Proc. Inst. Chemists (India),** *26, 87-98* **(1954).**

Investigation of a number of baths for Al sheets containing Si—0.28%, Cu—0.42, Mn—0.40%; best results with: H_3PO_4 (d. 1.75) 1750 ml., C_4H_9OH 435 ml., H_2O 210 ml.; temp. 40-50°; a.c., 45 amp./ft.^{2}; 14-38 volts; reflectivity = 81.6%.

"The Electrolytic Polishing of Al in the Presence of ClO_4^- ions." **Epelboin, I. Congress Intern. Aluminium, Paris,** *2,* **49-56 (1954).**

Pure Al surfaces can be obtained by electropolishing in perchloric acid or in alcoholic perchlorate solution. Best results are obtained if the anodic potential (U) is such that U/c.d. is a max. The author shows that U/c.d. max., a significant part of the potential drop across the cell, consists of a contact potential, U_c, caused by an absorption of ClO_4 anions and atomic H_2O on the anodes; U_c is at a max. when U/c.d. = max.; 21 references.

"Electrolytically Brightening Al-surfaces." **Hesch, F. H. (to Kaiser Al. & Chem. Corp.). U.S. Pat. 2,682,502 (June 1954).**

Aqueous solution, 1% (by wt.) H_3BO_3, 0.3% HF, 0.2% CrO_3, 0.3% glycerol. Temp. 175-190°F., c.d. 20 amp./ft.^{2}, time 3 min.

U.S. Pat. 2,682,503.

Aqueous solution, 0.23% (by wt.) sulfamic acid, 0.75% CrO_3, 0.29% HF, 0.31% glycerol; temp. 170-180°F., c.d. 10-80 amp./ft.^{2}

"Electropolishing of Metals." **Heyes, J. and Fischer, W. Ger. Pat. 908,548 (Apr. 1954).**

For electropolishing of metallic articles, especially of Fe, Al, and their alloys, a solution is used of $NaClO_4$ in glacial AcOH, which may contain a little water. Upon enrichment of the electrolyte with the basis metal, the precipitated salt is filtered off and the amount of acetate removed from the bath is compensated for by addition of glacial AcOH.

"Aluminum or Al-alloy Mirrors." **Inagaki, T. et al. (to Koito Mfg. Co.). Japan Pat. 8403 (Dec. 1954).**

Composition of Al sheet: 99.8% Al, Fe, 0.1, Si 0.098, Cu 0.002%. Electrolyte: H_3PO_4 (d. 1.50)—7.41 l., $C_3H_5(OH)_3$ (d. 1.27)—2.6 l., H_2SO_4 (d. 1.45)—1.7 l.; time 7 min.; temp. 45-50°C.; d.c. 0.16-0.45 amp./dm.^{2}; reflectivity of mirror: 86%.

"Electrolytic Polishing of Metals." **Jacquet, P. A. Metall,** *8,* **449-458 (1954).**

A description of the application and techniques of electrolytic polishing; 69 references.

"Electropolishing Apparatus for Stainless Steel and Aluminum." **Jumer, J. F. U.S. Pat. 2,665,247 (Jan. 1954).**

The bath composition is preferably: 5% polyethyleneglycol (200-400 mol. wt.), 93% H_3PO_4 (75%), 2% gluconic acid.

"Treatment for a Bright, Anticorrosive Metal Surface." **Koyama, A. Japan Pat. 4265 (1954).**

Zn, Cd, Cu, and Al or their alloys is immersed for a short time in a liter of H_2O containing 15-400 g. CrO_3, 20-400 ml. HCl (or chloride with equiv. Cl) and 2-40 ml. H_2SO_4 (or sulfate with equiv. SO_4^-), and then immersed for a short time in solution containing alkali or CrO_3 to obtain a bright anticorrosive metal surface.

"Physiochemical Brightening of Metals." **Sebastian, F. M. & Ribera, M. S. Inst. Hierro Acero,** *7,* **48-83 (1954).**

It is proposed that electrolytic & chemical polishing for formation of bright deposits have in common a periodicity phenomenon. On this basis a new mathematical theory is developed.

"Theory and Practice of Chemical Polishing." **Pinner, R. Electroplating & Metal Finishing,** *7,* **127-131, 140 (1954).**

The theory of the solution of metals, corrosion in acids, effect of oxidizing agents, reaction control (anode, cathode), anodic reaction and film growth, periodic film formation, films in chemical polishing, and diffusion control are presented; 13 references.

"The History of Electrolytic and Chemical Polishing." **Pinner, R. Electroplating and Metal Finishing,** *7,* **295-298 (1954).**

"Phosphoric Acid Anodizing of Al and its Application to Electroplating." **Spooner, R. C., and Seraphim, D. P. (Aluminum Labs., Ltd.). Trans. Inst. Met. Fin. 4th Int., Conf.,** *31,* **29-45 (1954).**

H_3PO_4 anodizing of high purity Al was studied to determine the effects of electrolyte concentration, temp., anodizing time, c.d., and air agitation on the coating weight, metal loss, and coating ratio and density.

"Problems in Polishing Al and Al-alloys." **Steiner, J. Metalloberflaeche,** *8,* **#5, B 65-69 (1954).**

Small ripples in rectified current have no deleterious effect upon its electropolishing action, while larger ripples have either a favorable or unfavorable effect depending on conditions.

1955

"Problems in Polishing Al and Al alloys." **Baumann, F. Z. Erzbergbau u. Metallhuettenw.,** *8,* **14-18 (1955).**

Discussion of polishing mechanism in electrochemically polished Al and Al alloy surfaces. Influence of partial passivation of the surface, effects of diffusion, and ion conc. of the polishing bath are considered.

"Patents on Chemical and Electrochemical Polishing and Brightening of Metal Surfaces Since 1940." **Baur, Hermann. Metalloberflaeche,** *9,* **A 22-28 (1955).**

A bibliography; 221 patents are listed, brief operating details and formulations for every patent are tabulated.

"Aluminum Alloys for Anodic Treatments." **Herenguel, J. Rev. Aluminum,** *32,* **903-906 (1955).**

Anodizing Al requires a precise definition of the composition of the metal and of previous processing to avoid reticulations or mottling. Spottiness and undulations are due to local differences in the oxidation rate. To obtain good results, Al must be as pure as possible; also alloys with 1-3% Mg.

"Brightening Solutions for Aluminum and Aluminum Alloys." **Hesch, F. H. (to Kaiser Al. & Chem. Corp.). U.S. Pat. 2,719,781 (Oct. 1955).**

Interdependent relative amounts of NH_4F and HNO_3 are shown in chart; to avoid haziness, Cu (0.001-0.1 g./l.) is added; time 5 min.; mechanical agitation improves up to 50%; after-treatment: dip in HNO_3 and rinse.

"Developments in the Field of Chemical Brightening of Al." **Lattey, R. & Neunzig, H. Metalloberflaeche,** *9,* **A 97-103 (1955).**

A review.

"Brightening Solution for Al and Al-alloys." **Murphy, J. F. (to Kaiser Al. & Chem. Corp.). U.S. Pat. 2,719,079 (Sept. 1955).**

Aqueous solution containing complex fluoride, HNO_3, and a metal electropositive to H; pref. HNO_3, fluoborate, $Cu(NO_3)_2 3H_2O$; in terms of 45% HBF_4 : F^- = 0.5-26 cc/l; 70% HNO_3 — 1:3-52 cc/l; $Cu(NO_3)_2 3H_2O$ = 0.05 g./l. Diagram of optimum results; temp. 190-210°F.; time 5 min.; mech. agitation. Brightening must be followed by HNO_3 dip and water rinse.

"Effect of Electropolishing on the Physicochemical Properties of the Surface of Pure Aluminm." **Shchigolev, P. V. (Zhur. Fiz. Khim,** *29,* **682-684 (1955).**

Reflectivity of Al plate was raised, e.g. 20%, by 2 min. electropolishing in Na_2CO_3—150, Na_3PO_4—100 g./l., and "Corrosion and Electrochemical Behavior of Electropolished Al." Measurement of I in 0.5 N Na_2SO_4, 0.5 N NaCl between Al and other metal plates.

"Electrochemical Structure of the Surface of Electropolished Aluminum." **Shchigolev, P. V. & Akimov, G. V. Doklady Akad. Nauk. S.S.S.R., 100, 499-502 (1955).**

Electrolyte: 150 g./l. anhyd. Na_2CO_3, 100 g./l. anhyd. Na_3PO_4; c.d. 3-3.5 amp./dm.^{2}; 12-14 v.; temp. 90°.

"Electrolytic Polishing of Aluminum." **Turner, H. L. (to Union Carbide & Carbon Corp.). U.S. Pat., 2,708,655 (May 1955).**

Articles of Al may be given a polish by first etching in a bath containing H_3PO_4—66, H_2SO_4—15, ethylene glycol mono ethyl ether—3, and H_2O—16% for approx. 60 sec. at 70-80°. After etching, the article is made anodic in the same bath and polished for 5-20 min. at 150 amp./ft.^{2} Cathodes are either Pb or C of about 6 times the surface area of the anode.

"Electrolytic Polishing of Metals." **Zaretskii, E. M. U.S.S.R. Pat. 101,536 (Dec. 1955).**

Electrolyte CrO_3. To regenerate Cr^{+3} to Cr^{+6} during process, an additional Pb-elec-

trode is wired parallel with the article being treated. The circuit of the additional anode contains a variable resistance to control the c.d. in the anode.

1956

"Electropolishing of Al." **Akabori, H. and Shibasaki, K. Japan Pat. 3109 (1956).**

(1) NaOH, 2-5; Na_2SO_4, 5-20; (2) NaOH, 2-5; Na_2S, 5-20; (3) NaOH, 2-5; Na_2SO_4, 10-30; (4) NaOH, 3-5; Na_2HPO_4 or Na_3PO_4, 5-20; (5) NaOH, 2-5; Na_2CO_3, 2-5; Na_3PO_4, 10; each in 100 parts H_2O. These electrolytes with addition of 45 Na-aluminate, 0.01-1%, Na-alginate, and 0.01-1% surface active agent give still better results. The Al is electrolyzed at 50-100°C. for 5 min. with d.c. at 15-40 v. at a c.d. of 30-300 amp./dm.^{2}

"Anodic Polishing." **Auer, L. (to Robert Bosch, G.m.b.H.). German Pat. 945,423 (July 1956).**

During polishing, oscillations of 1000-3000 hertz are produced at the electrodes. Thus, H_2 and O_2 forming at the electrodes are removed rapidly and the viscous layer of anodic products is preserved.

"The Mechanisms of Bright Dipping and Electropolishing." **Bruenner, H. Metalloberflaeche,** *10,* **295-299 (1956).**

A review.

"Treatment of Hexavalent Chromium Solutions." **Costa, R. L. (Allied Chem. & Dye Corp.). U.S. Pat. 2,733,204 (Jan. 1956).**

Accumulation of Al salts in solutions of hexavalent Cr cause the solution to become useless. Solutions may be reclaimed by treatment with cation-exchange resin consisting of sulfonated, infusible polymerizate of a polyvinyl aryl compound.

"Progress Achieved in Electrolytic Polishing. Application to the Study of the Physical Properties of Materials." **Epelboin, I. Corrosion et Anticorrosion,** *4,* **166-171 (1956).**

Conditions for optimum results in ClO_4^- containing solutions discussed. Results relative to electrolytic polishing of Al in Mg $(ClO_4)_2.2H_2O$ (200 g.) dissolved in 95% EtOH (1 l.) were given. Electrolyte polishing could be applied to obtain better (a) thermokinetic characteristics of thin wire, (b) electromagnetic properties of small pieces of equipment, and (c) surface state of semiconductors. Results illustrated by photomicrographs.

"Inhibition of Metallic Corrosion in Aqueous Media." **Gatos, H. C. Corrosion.** *12,* **23-32t. (1956).**

A brief discussion of current processes from electrochemical viewpoint. Organic and inorganic inhibitors. Several explanatory approaches to this study are given, as well as a number of inhibitors and their applications; 100 references.

"Electropolishing of Al and Al Alloys." **Guggenberger, K. (to Fromson Orban Co., Inc.). U.S. Pat. 2,751,342 (June 1956).**

Electrolyte: 1300-600 g./l. H_2SO_4; 3-40 g./l. CrO_3; cathode, Pb; temp. 80-90°; c.d. 25-50 amp./dm.^{2}; 13-20 volts; time, 5 sec. to 6 min.

"The Anodic Process in Electropolishing of Al with a Perchloric Acid-Alcohol Electrolyte." **Hansen V. and Knuth-Winterfeldt, E. Metalloberflaeche,** *10,* **299-300 (1956).**

Cl formed at anode in $HClO_4$-EtOH. Al is activated anodically and oxidized to a state less than 3, this low valent Al-oxide in turn reduces $HClO_4$ to HCl.

"Electrolytic and Chemical Polishing." **Jacquet, A. Met. Rev.,** *1,* **157-211 (1956).**

A review with 130 references.

"Anodic Polishing Solutions." **Kutzelnigg, A. and Gruettner, S. (to Dr. Hesse & Co). German Pat. 936,124 (Nov. 1956).**

Addition of 0.02-1, pref. 0.05 g/l polyvinyl alcohol, polyvinyl acetate, especially polyvinyl amine and polyvinyl pyrolidinone to mixture of H_3PO_4—H_2SO_4 gives a better polish. Before anodic polishing, the metal is dipped into the liquid without current for about a min.

"Electrolytic Polishing of Al." **Mitsuo, O. (to Yuko Al. Mfg. Co.). Japan Pat. 859 (Feb. 1956).**

Electrolyte of 500 ml H_2SO_4 (d. 1.4); 40 g. Na-aluminate, and 20 g. CrO_3, for 0.5-1.0 min., at 60°, at 10 amp./dm.^{2}, and 16 v. gave a mirrorlike finish.

"Electropolishing Composition." **Smith, H. (to Electro-Gleam, Inc.). U.S. Pat. 2,773,821 (Dec. 1956).**

A group of inhibitors comprising: 30-40% orthophosphoric acid, 10-20% hydroxyacetic acid, 25-35% H_2SO_4, 5-25% benzenesulfonic acid, 2-12% toluenesulfonic acid, 5-15% H_2O; 54.5-55.2° Bé. at 71°C (density corrections by H_2O); temp. 60-90°C; 6-12 volts; c.d. 60-200 amp./ft.^{2}

"The Electrolytic and Chemical Polishing of Metals in Research and Industry." **Tegart, W. J. Pergamon Press, London, England, 129 pp. 1956).**

"Electrolytic Polishing of Metals." **Turner, Hubert L. (to Union Carbide & Carbon Corp.). U.S. Pat. 2,752,305 (June 1956).**

Electrolyte for Al or Al-rich alloys: H_3PO_4 67.5% (by wt.), H_2SO_4 15.5%, Na-glycerophosphate 1%, H_2O 16%; temp. 70-90°. c.d. 150 amp./ft.^{2}; time 2-20 min.

"Commercial Anodic Surface Treatments for Al and its Alloys." **Vanden Berg, R. V. Plating,** *43,* **221-232 (1956).**

Anodizing and electropolishing are reviewed.

"Surface Treatment and Finishing of Al and its Alloys." **Wernick, S. and Pinner, R. Teddington, England; R. Draper, 580 pp. (1956).**

1957

"Decorative Coloring of Polished Al-articles." **Blagoveshchenskaya, R. N., and Sergeev, L. N. Tsvetnye Metally,** *30,* **#8, 31-33 (1957).**

Pressed Al articles, electropolished in solution, containing H_3PO_4 40, H_2SO_4 40, CrO_3 3, and H_2O 17% at 80-90° and 17 v. for 5 min. at 12 amp./dm.^{2}, or for 3 min. at 17 amp./dm.^{2}, retained their luster after anodizing and dyeing.

"Surface Treatments of Al and its Alloys Electrolytically." **Flusin, F. Bull. Soc. Franc. Electricien,** *7,* **553-560 (1957).**

The possible treatments in an electrolyte are discussed under 3 headings, explaining the mechanism of electropolishing. For polishing, baths based on P_2O_5 with additions of H_2SO_4 or HNO_3 are used at 80-110° for 1-6 min., or a bath based on NH_4HF_2 and HNO_3 is used at 50-60° for 15-30 sec.

"New Al Electropolishing Bath." **Levin, L. E. and Rudak, I. G. Priborostroenie, #8, 25 (1957).**

Bath containing ethyleneglycol (1) and H_3PO_4 with or without added H_2SO_4 (15% of H_3PO_4, if used) have excellent working properties and long life. Typical comp.: 1000 ml H_3PO_4 (d. 153) with 200-500 ml I; temp. 85-95°C; c.d. 12-15 amp./dm.^{2}; time 4-6 min.; using a moving chrome-nickel-steel anode. Up to 30 g/l Al does not affect bath performance.

1958

"Anodic Oxide Coatings on Al and Al Alloys." **Ernst, R. (to Sanford Process Co., Inc.). U.S. Patent 2,855,350 (Oct. 1958).**

Hard Al oxide coatings in acid bath containing 0.02-0.10 mol/1 2-aminoethylsulfuric acid.

U.S. Patent 2,855,351.

Bath containing 0.02-0.10 mol/1 of n-methyltaurine or related compounds of the type $RR'NCH_2—CH_2—SO_3H$.

"Electropolishing Copper, Brass and Aluminum." **Lorking, K. F. Metal Finishing,** *56,* **#3, 64, 68 (1958).**

For Al, the bath used contained 70 ml of H_3PO_4 (d. 1.75), 72 ml of glacial AcOH and 8 ml H_2O. The specimens were washed in alcohol or acetone immediately after the current was disconnected, to prevent etching; temp. 70-75° with a c.d. of 0.5-0.8 amp./in.^{2}

"Influence of Electropolishing on the Corrosion of Al in Diluted Solutions of HNO_3." **Malinowska, A. Przemysl Chem.,** 336-338 (1958).

Al electropolishing bath: CrO_3—10, $H_2C_2O_4$—2, Na_3BO_3—2, H_3BO_3—1, H_3PO_4—1 wt.%. Pulsating current. Al anode placed between two graphite cathodes; d.c. with superimposed (via a condenser); a.c. of 2.5 v. and 0.68 amp./dm.^{2} at 48.5° for 30-60 min. Best results when d.c. was also 0.68 amp./dm.^{2} and average mean voltage 26-28 v.

"Electrolytic Polishing of Metals." **Siemens & Halske, G.m.b.H. Austrian Pat. 196,195 (Feb. 1958.)**

In a process for electropolishing metals, borates, perborates, or boric acid are added to the electrolyte, the main ingredients of which are H_2SO_4 and H_2O. Preferably, perborate is added in an amount 0.01 g/l until saturation.

Acknowledgements

The writer is indebted to *Dean T. Stephen Crawford* for the permission to publish the survey. Thanks are due to the author's two undergraduate assistants, *Carl H. Layer* and *Richard A. Durst,* who helped compile the references.

Science for Electroplaters

50. Copper Plating - II.

By L. Serota

This is the conclusion of Part L of this series. The first half appeared in the August issue.—*Ed.*

Arithmetic Average — RMS

The wide use of tracer instruments for measuring surface smoothness (profile) has led to two methods for assigning numerical values to such measurements: namely, the arithmetic average distance of curves from a "mean" line, with sign indicating a value above or below the mean line; and the root mean square (RMS) representing the microinch, μ in. average distance from the mean line. The arithmetic average is now preferred because of the simplicity in calculation from a profile curve. A microinch is one millionth (0.000001) of an inch and a micron, μ, = 0.001 mm. Since 1 mm = 1/25.4 or 0.039 inch, a micron = 0.000039 inch or 39μ in. A numerical value of 0.5μ in. is equivalent to 0.013μ (0.0000005/0.000039). Fig. 202 represents the methods employed for calculating RMS and arithmetic averages from a surface profile. Table 1 is a convenient grouping of such conversion units.

Anodes

The use of copper anodes in acid copper plating baths introduces the troublesome factor of anode sludge formation which consists essentially of fine metallic particles of copper. Such particles will, in the process of electrolysis, deposit on the cathode, causing rough deposits and nodules.

W. Blum attributes this effect to dissolution of the copper anode with the formation of the cuprous salt, Cu_2SO_4, or Cu^+, which is oxidized by the air to the higher valence or cupric, Cu^{++}, state. As a result of this oxidizing action, copper will continue to dissolve. Since twice as much copper (as cuprous sulfate) will dissolve per faraday, compared to the amount which would dissolve in the cupric state, the anode efficiency in this bath will be more than 100 per cent.

A copper anode, merely standing in an acid bath, will dissolve by the action of the cupric sulfate on the copper.

Table 1

Conversion of Units Used in the Dimensional Analysis of Surfaces

inch		microinch	millimeter (mm)		microns (μ)
1			25.4		
0.1	10^{-1}		2.54	2.54	
0.01	10^{-2}	10,000	0.254	2.54×10^{-1}	254
0.001	10^{-3}	1,000	0.0254	2.54×10^{-2}	25.4
	10^{-4}	100	0.00254	2.54×10^{-3}	2.54
	10^{-5}	10		2.54×10^{-4}	0.254
	10^{-6}	1		2.54×10^{-5}	0.0254
	10^{-7}	0.1		2.54×10^{-6}	0.00254
	10^{-8}	0.01		2.54×10^{-7}	0.000254

10^{-7} mm = 1ÅE (Angström Unit)

The equation for this latter reaction is as follows: $CuSO_4 + Cu \leftrightarrows Cu_2SO_4$. The equation for the reaction representing the oxidation of cuprous sulfate to the higher valence state is as follows: $2Cu_2SO_4 + O_2 + 2H_2SO_4 \rightarrow 4CuSO_4 + 2H_2O$.

It is evident from the equations that an increase in copper sulfate and a decrease in sulfuric acid will result. Removal of some of the solution and addition of more water and sulfuric acid become necessary to maintain a uniform bath composition. An alternative procedure recommended is the replacement of some of the copper anodes in the bath by lead anodes. Control is then reduced to routine analysis and replacement of acid due to drag out. With the use of lead anodes, the liberated oxygen produces an irritating spray, so that adequate ventilation becomes necessary. J. H. Winkler notes that two to three times as much acid is used when lead anodes are not employed.

R. P. Nevers and associates favor anodic dissolution, whereby cuprous sulfate is converted to cupric sulfate and copper, since the average particle size, which they found by measuring anode sludge under the microscope, was only 0.001 mm diameter, a measurement much smaller than the diameter of the smallest grain size from a wrought or cast anode.

As part of this investigation, the authors made a study of the effect of certain impurities, present in the copper anode, upon the deposit from an acid bath. It was found that some elements, when included in the anode, will leave a dark brown adherent film on the anode during electrolysis, thereby eliminating the formation of an anode sludge of metallic particles as well as producing a smooth, thick, nodule-free deposit on the cathode. Such results were obtained when more than 0.005 per cent of the elements

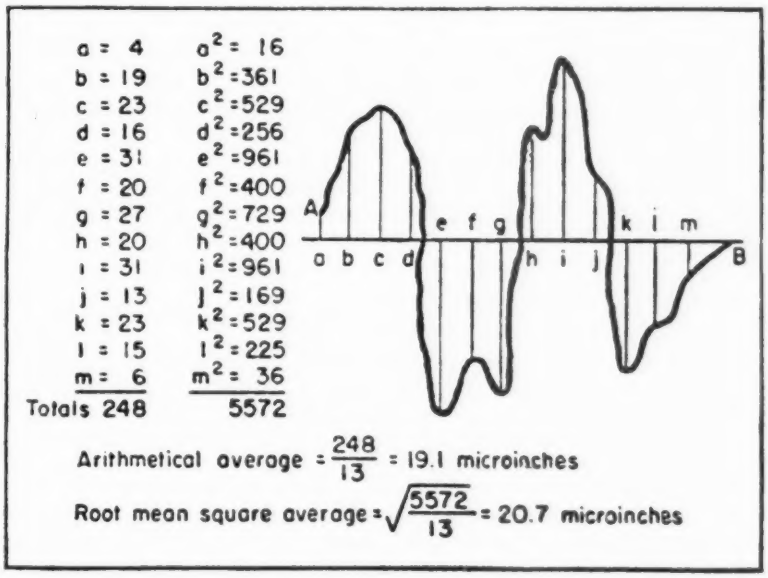
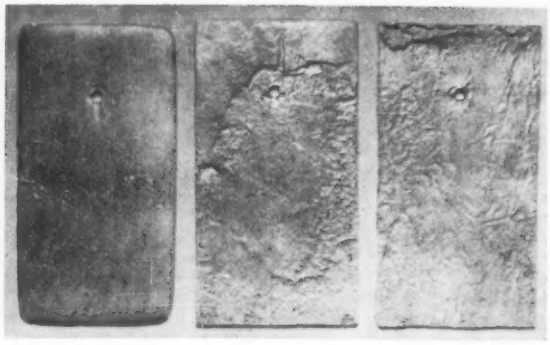


Fig. 202. Root Mean Square evaluation of surface roughness.



Phosphorized copper *Fire-refined copper* *Electrolytic tough pitch copper*

Fig. 203. Corroded anodes. ⅜ actual size.

phosphorus or arsenic were present in the anode.

When anodes of high purity were used instead, in this series of experiments, heavy coatings of loosely adherent aggregates of fine particles formed on the anode. These coatings were easily detached, giving the solution a turbid appearance. Roughness of the surface of the cathode deposit was shown to be due to such minute copper particles. Deposition on the cathode using these high purity anodes was only 85 per cent of the copper obtained from the anode. The balance of the copper was considered to be present as copper particles in the anode sludge or in the formation of additional copper sulphate.

By comparison, it was found that an anode of fire-refined, impure commercial copper, formed in the early phase of the electrolytic process an adherent dark gelatinous film which reduced turbidity of the plating solution appreciably as well as virtually eliminating suspended fine copper particles. With this type of anode, cathode deposits represented about 98 per cent of the loss of anode weight, no anode sludge formed, and salt concentration was negligible. The composition, in per cent, of the fire-refined copper anode was listed as follows: copper 98.899; oxygen 0.0422; sulfur 0.0041; selenium 0.0025; tellurium 0.0013; silver 0.0095; arsenic 0.0049; antimony 0.0014; iron 0.0031; nickel 0.0157; bismuth 0.00004. Arsenic, investigation showed, was the principal contributing element to the improved results, with selenium, tellurium, and silver serving as supplements.

Because fire-refined copper is not readily available, does not corrode uniformly, and varies in composition, a wrought anode from high purity copper, to which 0.02 to 0.03 per cent phosphorus was added, was found to be most favorable for the acid copper bath. A thin, black, firmly adherent film formed during electrolysis, copper particles did not appear, and the solution remained clear. Corrosion of the anode was uniformly smooth, an effect strikingly shown by comparison with fire-refined and electrolytic tough pitch copper in Fig. 203.

W. F. Safranek and C. L. Faust investigated the quality of deposits from an acid copper bath using improved oxygen-free high-conductivity anodes, with deposits obtained from the same type of bath using rolled, electrolytic, or cast anodes. Based upon results obtained by Nevers and associates, 0.019 per cent phosphorus was included in the high purity oxygen-free anodes used. Diaphragms or anode bags were not used.

Results showed that, with oxygen-free anodes, deposits did not display nodules, whereas nodule deposits resulted when other anodes were used. The high purity anodes dissolves more uniformly and left less scrap than that obtained with the other anodes. The anode current efficiency for these high purity anodes was 101 per cent, indicating only a slight increase in copper concentration. The greater benefits of this quality of high purity anodes are reflected in the report by the authors that over 2 million pounds of these castings have been used for copper plating since their development in 1952.

Impurities

Although tolerance to impurities in the acid copper bath is relatively high, since the difference in deposition potentials for metals commonly present as impurities virtually eliminate the possibility of codeposition with copper, increasing concentrations of impurities will affect plating conditions adversely. Thus, J. F. Beaver notes that iron present in large quantities reduces the solubility of copper sulfate, decrease conductivity in the same proportion as an equivalent increase in copper, and may be the cause of polarization. This latter condition, it is suggested, may be overcome by an increase in temperature and anode area. The author indicates that the only impurities that may harm the deposit are oils and other hydrocarbons. This type of compound may cause brittleness, pitting, and loss of luster. Carbon filtration can eliminate the difficulty.

E. F. Kern and M. Y. Chang found that nickel decreases the conductivity of the acid bath in copper refining. A 6.4 per cent reduction in conductivity, at 25°C., resulted when 10 grams of nickel as sulfate was added to a solution containing 137 grams $CuSO_4 \cdot 5H_2O$ and 135 grams free H_2SO_4. M. R. Thompson reported, during a discussion period for this topic, that an increase in nickel content from 0 to 30 g./l. to the same concentration of copper solution decreased the conductivity at 40°C. by 17 per cent.

In an investigation of the function of the chloride ion in copper refining, Yu-Lin found that a concentration of 15 mg./l. chloride will act as a cathode polarizer, refine the crystal size and increase the hardness of the copper deposit. Above this concentration, the chloride ion acts as a cathode depolarizer and reverses the effect on grain size and hardness of deposit. Experimental procedure, it is emphasized, did not include impurities and addition agents. Such additions would change the results obtained. The important effect of the chloride ion in this bath, Yu-Lin notes, is in the reduction in crystal size of the copper deposit.

Electroforming

Electroforming refers to a process whereby an article may be produced or reproduced by electrodeposition. N. Hall, commenting editorially in METAL FINISHING, 1956, on the broadening scope of this process, indicates that the term electrofabrication, which he suggested in 1936, would be more descriptive for this operation. Application extends to such diverse fields as electrotyping, sound records, master coin dies, printing plates, thin copper sheets,

printed circuits, metallic screens, tubes, fittings, heat exchangers, electroform molds for rubber gloves, etc.

M. Rubinstein cites the following advantages, productionwise, for electrofabrication: easily controlled metallurgical properties, extremely close tolerances (± 0.0001 inch), high surface finish, size or shape unlimited, precise duplication of contours such as an engravery's mark 0.00002 inch wide. Some disadvantages include: longer period of time to produce, reproduction of smallest scratch or imperfection on surface, need for skilled technical designing for each job, and relatively expensive method of production.

Although the acid copper bath is preferred for many applications of electrofabrication because of the simplicity of operation, ease of control, low cost of chemicals and current, developments during the past 15 years have been such that an extensive range of properties is made available by variations in the metal applied or by plating the same metal from different baths. Nickel, iron, silver, lead, nickel-cobalt alloys, in addition to copper, are now employed in this process.

The essential steps in electrofabrication include: formation of a mold (or mandrel), the electrodeposition of a metal on the mold, removing or separating the deposit (metal form) from the mold, and finishing. In some procedures the application remains attached to the base. For this latter process, firm adhesion of the plated object to the mold is essential, a procedure entailing roughening of the surface as a preliminary step to the plating operation. Where removal of the electroformed object from the mold or mandrel on which the object is plated is considered, the treated metal surface must be conductive but exhibit sufficient adhesion so that the deposited object does not separate prior to completion of the process.

Molds and Mandrels

Both metallic and non-metallic materials are used for molds or original shapes on which the electrodeposit forms. This basic form must be carefully prepared, since the electrofabricated part will be an exact negative reproduction of the product. Metal molds may be prepared by casting, pressure forming (molding), machining or electrodeposition.

Cast molds, useful for producing cast-metal negative molds, are prepared from low melting alloys such as Wood's metal (melting point about 158°F.) consisting of 50% bismuth, 25% lead, 12.5% tin, 12.5% cadmium; or a modified bismuth, lead, tin, cadmium mixture with the same approximate melting point. The advantages for this type of mold include the ability to make such castings in metal, plaster, or plastic positives, and the ease of removal of the casting from the electrodeposited form, without damage to the shell, by melting when submerged in hot water.

For producing metal molds by pressure, the commonest example is lead molding for electrotype. Wax and plastic molding are also used. Both cast and pressed molds are used but once (temporary mandrels). Electrodeposited molds are adaptable for engraved printing and sound records because of the accuracy of electrolytic reproduction.

The surface passivity characteristic of chromium alloy, steel, aluminum, magnesium, tantalum, and chromium plating is indicated by W. H. Safranck and J. H. Winkler as the reason why these metals are more suitable as metallic mandrels, since the need of a surface coating for conductivity or a separating film for removal of the electrofabricated object is eliminated.

The suggestion is advanced that removal of such natural oxide films by means of reverse sulfuric acid (20-50%) bath will eliminate unevenness of the film and the chance of the deposits adhering in spots. A more homogeneous film may then be applied. Chromates, sulfides, and iodides are other chemical parting media (separators) employed.

Another type of parting medium is the mechanical film, which includes such surface coating agents as paints, varnishes, lacquers, waxes, and grease. Dipping, brushing or spraying methods are employed. Finely divided graphite of 0.000002" grain thickness may also be brushed on. This latter agent is not as commonly used now.

A third type of film is the fusible metal separator film. A film 0.0001-0.002 inch thick of a low melting point metal, such as lead, tin, cadmium or an alloy of these metals, is plated on the mandrel before electrofabrication. When the process is completed the fusible metal film is readily removed by immersion in hot oil, which provides a sufficiently high temperture to melt the metal or alloy.

Non-metallic substances used for mandrels or molds, such as glass, rubber, asphalt, plastic, wax, ceramic, wood, or leather, must be made surface conductive. Porous materials, such as wood, ceramics, leather, or plaster, must first be treated so that the pores are sealed. Immersion or soaking in melted wax is usually employed for the sealing step. Wax may also be applied by using a wax solution. When a wax solution is applied a volatile solvent must be used. Shellac, lacquers, or waterproof varnishes are also used.

Conductive films of copper, bronze powder, or graphite are applied to wax or varnish, and a chemically deposited (precipitated) silver film may be applied to wax, glass, or plastic surfaces. Plastic or glass surfaces are usually sensitized with a stannous chloride solution before coating with silver. An ammoniacal silver solution and a reducing solution, such as Rochelle salt or formaldehyde, are applied at the same time. The solution preparation and procedure are those for mirror silvering. Graphite and metal powders are applied by dusting, brushing, or spraying, using a liquid medium such as water, alcohol or thinner.

Applications

Electrotype shells are now formed, to a great extent, from a vinyl acetate-vinyl chloride copolymer plastic molding medium instead of wax. The heated surface, upon which printed surface impressions are made, is sensitized with a stannous chloride solution and silver coated by a reduction operation. Copper is then electrodeposited from an acid copper bath at an initial low current density. The deposition rate is increased by raising the current density to approximately 300 amp./ft.^{2} for about one hour. The thickness of the electrolyte shell will range from 0.007 to 0.015 inch. The edges of the shell are then trimmed, the back tinned and backed up with electrotype metal (94% lead, 3% tin, 3% antimony). J. H. Winkler gives the following formula for the copper bath: copper sulfate 250 g./l., sulfuric acid 75 g./l., temp. 38°C. (100°F.), air agitation.

Sound recordings are prepared by making an original recording on a thin wax or cellulose acetate coating on an

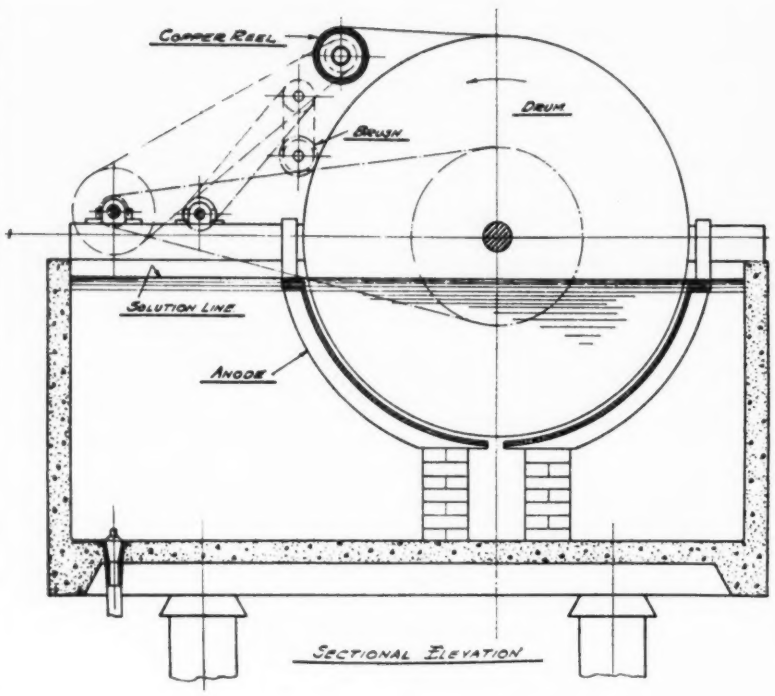


Fig. 204. Sectional elevation of drum equipment.

aluminum disc. The surface is made conductive with a gold or silver film, after which it is nickel plated, followed by a copper deposit (flash) from a low concentration acid copper bath at 20 amp./ft.^{2} Electrofabrication follows, by depositing 0.025-0.030" copper from a high speed acid copper bath using rotating holders. This form is known as the master matrix or negative shell. A number of metal positives are then reproduced, using the procedure of nickel plate, copper flash, and copper build up. The master matrix is previously cleaned and treated with a 5 second dip in a dichromate solution to facilitate separation. From the latter positive forms, also known as mothers, a group of plates known as stampers are produced by the same process. The stampers or negative shells (usually chromium plated for easier separation and longer wear are used as dies for producing the playing records from thermoplastic materials.

Thin sheet copper in wide widths and long lengths is electrofabricated, on a commercial scale by depositing copper on some form of endless cathode such as a revolving drum or cylinder. A sheet weighing up to 7 oz./ft.^{2} may be produced with this type of cathode.

A lead covered copper drum (cathode) is mounted and partly immersed in a lead-lined tank, with lead anodes spaced about ½ inch from the drum. The electrolyte, acid copper, flows in and out of the tank continuously. Fig. 204. Compressed air aids gas ebullition at the anodes. The deposited sheet is continuously removed from the surface of the drum after one revolution. The surface of the sheet next to the drum has bright satin finish, with the other side exhibiting the characteristic appearance of deposited copper. The surface of the lead is scraped by a mechanical device at each revolution to maintain the satin copper finish.

A. S. Krasden refers to the preference for electroforming in the manufacture of pitot tubes, because this process provided the most satisfactory and practical way of obtaining a shell of any form around the assembled unit. The acid copper bath was used because copper met such requirements most satisfactorily for the electroplated shell as sufficient strength for a sound structure, good heat conductivity, good rate of deposit, and smooth surface.

SHOP PROBLEMS

BARREL FINISHING — POLISHING AND BUFFING
CLEANING — ANODIZING — ELECTROPLATING
RUSTPROOFING — LACQUERING AND ENAMELING

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Anodizing Aluminum

Question: We are interested in putting in more tanks in with our chrome and nickel. Please send any information you can on aluminum anodizing pertaining to what equipment is necessary, what supplies are needed, and how to process the aluminum pieces.

Anything you can help us with will be very much appreciated as we have customers who wish us to handle their products.

F. S. H.

Answer: There is no standard installation for anodizing, since the equipment and cycle are determined by the type of alloy, the type of anodic coating required and the finishes desired, in addition to the volume of production needed. Parts may be bright dipped or etched, chromic or sulfuric anodized, and sealed clear or dyed.

Information on the process will be found in any recent edition of the METAL FINISHING GUIDEBOOK and, for complete details, we would suggest you obtain a copy of the book, "Surface Treatment and Finishing of Aluminum and Its Alloys" by S. Wernick and R. Pinner.

Plating equipment suppliers will be happy to study your requirements and to recommend specific equipment and cycles.

Plating on Aluminum

Question: We have some aluminum parts which have to be copper plated 0.0005", silver 0.0005" and then gold flashed. Despite our carefully planned process, we have blisters which occur when the parts are subjected to heat treatment of 300° F. for one hour, although at the time there is no evidence of blisters.

Our procedure is as follows: aluminum etch cleaner, cold rinse, acid dip, rinse, acid dip, rinse, zincate, rinse, copper strike, copper plate, rinse, silver strike, silver plate, rinse, gold flash, and dry. I neglected to mention above that the parts are first degreased.

Could you please make any recommendations or point out in the above procedure just where we are erring and how we can overcome this difficulty.

H. G. S.

Answer: Very often, good adhesion on aluminum is obtained by the use of what is known as the "double zincate" cycle. After the zincate dip and rinse, the parts are stripped in the acid dip, rinsed, and zincated again.

Deposition of Chromium-Nickel Alloy

Question: We are in need of a chrome-nickel alloy plating solution and have hopes you might be able to help us.

The required alloy deposit should have a composition of 50% nickel, 50% chrome. Appearance and hardness are not factors. We would appreciate any suggestions you might be able to make.

S. A.

Answer: A solution which deposits an alloy of nickel-chromium was reported by Quaely [Plating, *40*, 982 (1953)] and was patented a few years later. The solution consisted of:

Chromic acid	26.8 oz./gal.
Nickel chloride	2.68 "
Acetic acid	0.65 fl. oz./gal.

At high amperages, the solution deposited a black alloy with about 5% nickel. It may be possible to obtain higher nickel contents by modification of the bath.

An old patent (U. S. #1,948,145) suggested a solution of:

Nickel sulfate	32-96 oz.
Chromic carbonate	16-32 "
Boric acid	2 "
Water	1 gal.

Suggested operating conditions were 25 amp.sq.ft., using anodes of 75% nickel and 25% chromium content.

Gray-Nickel Bath

Question: We would like to secure information concerning any type of gray-finish on richlow or yellow brass. We have tried arsenic but this color is too dark for our particular application, but is worth more consideration.

We understand there is a gray-nickel bath. If you have any information concerning this type of bath or any other gray finish we would greatly appreciate it.

W. H.

Answer: Two gray nickel baths are available.

1. Nickel ammonium sulfate 8 oz./gal.
   Sodium thiocyanate 2 "
   pH 6.6
   Room temperature 1.5-2 amp./ft.^{2}
   Nickel anodes are used and the bath requires about 0.75-1.5 volts.
2. Sodium pyrophosphate 20 oz./gal.
   Nickel sulfate 2.7 "
   Ammonium aluminum sulfate 2 "
   Potassium cyanide 1 "

The pyrophosphate is dissolved in two-thirds of the water and the nickel salt in the balance. The two are mixed, after which the alum and, finally, the cyanide are added.

A flash deposit from a sulfate type iron bath may produce a suitable finish. Formulas will be found in the METAL FINISHING GUIDEBOOK.

Passivation

Question: Our customer is welding together some parts made of Hastelloy "C" and some parts made of Monel metal. They have asked us if we can

passivate the Monel. Since we have been unable to find anything regarding this process in the METAL FINISHING GUIDEBOOK or in our American Society of Metals Handbook, we are writing to you in the hope that you can tells us whether Monel metal requires passivation and if so, how to do it.

B. H. R.

Answer: Monel, similarly to stainless steel, is self-passivating on exposure to air. So-called passivation of stainless steel is really a treatment to dissolve out any particles of iron that might be lodged in the surface and result in subsequent rusting. Monel, not containing any iron, does not require such treatment.

Pickle Analysis

Question: Your question and answer to "Pickling Solution Analysis" that appeared in METAL FINISHING May, 1959 issue, page 74, is of interest to me. Would appreciate receiving the value of one ml. of the 0.5 N sodium hydroxide solution in terms of free acid content and ferrous sulfate.

T. C. S.

Answer: The reactions involved in titrating pickling solutions with sodium hydroxide are neutralization of the free acid, after which the iron is precipitated as ferrous hydroxide, according to the following equations:

1. $2NaOH + H_2SO_4 = Na_2SO_4 + 2H_2O$
2. $2NaOH + FeSO_4 = Na_2SO_4 + Fe(OH)_2$

Each ml. of 0.5 N NaOH is equivalent to 0.0246 gram sulfuric acid and 0.0140 gram iron.

Any iron present in the ferric form will introduce an error, since it will combine with an additional molecule of sodium hydroxide. However, the ferric content of a pickling solution is usually negligible.

Delayed Blistering

Question: My problem is this: I am told by our inspector that parts inspected in his department and passed will blister after lying around for two or three days. I maintain that if the inspection does not show blisters when inspected, they will not show two or three days later. We copper flash, nickel, and chrome plate plumbers brass goods.

F. J. C.

Answer: It is not uncommon for parts which appear satisfactory after plating to develop blisters after a few days. Although the chromium plating operation usually discloses poor adhesion, this cannot be depended upon. A suitable inspection test would be to heat the parts or to peen the surface with a vibrating hammer, such as a Burgess engraving tool, using the round tip.

Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Cover Paint

U. S. Patent 2,865,776. *Dec.* 23, 1958. *T. Rehner and P. Hartmann, assignors to Walter Marx & Co. K. G.*

A cover paint suitable for use as a protective coating over a base layer of rust-protecting paint, and comprising a uniform dispersion of aluminum leaf particles in a paint vehicle, said aluminum leaf particles having a mean longitudinal dimension of 5 microns and a maximum longitudinal dimension of 10 microns and a thickness of from 0.01 to 0.1 micron, the specific surface area of said aluminum leaf particles being from 70,000 to 90,000 square centimeters per gram, the weight of said aluminum leaf particles in the dispersion constituting a small fraction of the weight of the paint vehicle.

Electroforming Process

U. S. Patent 2,865,821. *Dec.* 23, 1958. *R. Jonke and J. Lintner.*

In a process for providing by electrodeposition a relatively thin walled metallic piece having a front face and a back face honeycomb design and likely to be subjected to static and thermal stresses with supporting ridges adapted to be electroplated, the steps comprising fixing said supporting ridges on to said back face of said metallic piece so as to form a current-conducting assembly and electroplating said supporting ridges as well as said back face of said metallic piece with a suitable metal thereby obtaining a metallic piece of honeycomb structure, provided on its back face with reinforcing electroplated supporting ridges surrounded on all sides by an homogeneous metallic mass and without its front face being in any way altered.

Electrostatic Spray Coating System

U. S. Patent 2,865,789. *Dec.* 23, 1958. *J. W. Juvinall, assignor to Ransburg Electro-Coating Corp.*

The method of applying porcelain enamel to an article, comprising feeding porcelain enamel slip at a controlled rate to the surface of a rotating disc, said slip having a fineness of grind represented by in the order of 5 P. C. units measured on a Fineness of Grind Gauge, containing an anti-tearing electrolyte and having a specific gravity of substantially 1.65, moving the article to be coated along a predetermined path in coating relation with said disc, creating an electrostatic field of high potential gradient between the disc and the moving article, atomizing the slip from said disc into said electrostatic field to form an electrically charged spray of dispersed porcelain enamel particles, and electrostatically depositing the porcelain enamel particles onto the article to form a bisque, said atomization and deposition being carried out in a quiescent atmosphere.

Reclaiming Pickling Wastes

U. S. Patent 2,865,823. *Dec.* 23, 1958. *A. W. Harris and C. D. Stricker, assignors to U. S. Steel Corp.*

A method of reclaiming waste hydrochloric-acid pickle liquor which consists in dissolving from 10 to 20% of hydrogen-chloride gas in the liquor until the hydrochloric acid concentration is from 20 to 25%, cooling the liquor to crystallize ferrous chloride, separating the crystals from the liquor, electrolyzing a water solution of the crystals in a cell wherein an anionic membrane separates the anode and cathode thereby depositing iron at the cathode and releasing chlorine at the anode, burning the chlorine in a hydrogen atmosphere to form fresh hydrogen chloride and contacting the hydrogen chloride so formed with additional liquor.

Sheet Electroforming

U. S. Patent 2,865,830. *Dec.* 23, 1958. *J. Zoldas, assignor to The Anaconda Co.*

Apparatus for producing sheet metal by electrodeposition from an electrolyte solution, comprising a cathode drum mounted for rotation on a horizontal axis, a cylindrically curved anode anode mounted in closely spaced relation with the cathode drum, and means for projecting a flow of electrolyte into the space between anode and cathode comprising a discharge manifold extending along an edge of the anode.

Spray Painting Machine

U. S. Patent 2,866,434. *Dec.* 30, 1958. *H. E. MacArthur and R. B. Way, assignors to Conforming Matrix Corp.*

An automatic machine operated solely by fluid pressures for controlling the spray painting of articles.

Electroplating Machine

U. S. Patent 2,865,831. *Dec.* 23, 1958. *N. Ransohoff, assignor to N. Ransohoff, Inc.*

An electroplating machine comprising a plating barrel rotatable about a generally horizontal axis in plating and discharge direction, said barrel having opposite end walls, said end walls having central openings generally concentric with said horizontal axis, one of said openings providing drainage and delineating the liquid level of a plating bath in the barrel, the barrel adapted to contain a batch of parts in the presence of a plating bath, cathode means within the barrel conducting the cathode side of a plating circuit to the batch of parts, an anode basket mounted within the barrel rotatable therewith and adapted to contain a batch of metallic anode pieces, means conducting the anode side of the plating circuit to said batch of anode pieces, the anode basket being generally concentric to the said horizontal axis of rotation and having a periphery passing through the level of a plating bath delineated by said central opening, whereby the plating circuit is completed from the batch of anode pieces to the batch of parts through the plating bath with the anode pieces and parts maintained in a state of agitation within the rotating barrel during the plating operation, a charging cone having a charging scoop mounted on one end wall of the barrel and communicating with the central opening thereof, said charging scoop advancing parts to be plated through said central opening into the plating barrel during rotation thereof in plating direction, and a discharge tube mounted on the opposite end wall of the plating barrel and communicating

with the interior of the barrel at the periphery thereof, said discharge tube discharging the plated parts from the barrel during rotation thereof in said discharge direction after the plating operation is completed.

Abrasive Separator

U. S. Patent 2,866,547. *Dec.* 30, 1958. *W. I. Gladfelter and M. E. Fahrney, assignors to Pangborn Corp.*

An apparatus for separating reusable abrasive from a mixture of granular solids.

Rhodium Bath

U. S. Patent 2,866,740. *Dec.* 30, 1958. *F. H. Reid, assignor to The International Nickel Co., Inc.*

An electrolyte for producing substantially crack-free rhodium electrodeposits comprising an aqueous acidic bath containing dissolved rhodium derived from at least one compound from the group consisting of rhodium sulphate, rhodium phosphate and rhodium fluoborate in an amount to provide from about 5 to about 20 grams per liter of rhodium, free acid in an amount sufficient to prevent hydrolysis and a compound from the group consisting of selenic acid and alkali metal salts thereof in an amount equivalent to about 0.05 to about 25 grams per liter of selenic acid.

Crackle Finish

U. S. Patent 2,866,720. *Dec.* 30, 1958. *W. H. Martin and E. B. Morin, assignors to American-Marietta Co.*

A method of making an ornamental protective crackle coating on the surface of an object comprising applying a uniformly pigmented thermosetting synthetic resin enamel base coating in a volatile organic solvent to said surface, permitting the solvent to evaporate from said base coating until the thermosetting resin is set in an immobile solvent-wet condition in which further application of organic solvent from an external source does not lift the pigment nor the resin therein and does not alter the gloss thereof nor spot the same, thereafter spraying onto said base coating in the form of liquid droplets a liquid translucent coating composition in which the vehicle consists of a volatile organic solvent and which contains a light-stable, thermoplastic, low water-absorptive synthetic film-forming polymer as the film-forming agent dissolved therein to form translucent film island areas of substantially uniform thickness which adhere to said base coating, whereafter said coating and base coating are dried to firmly unite said coating to said base coating.

Porcelain Enamel for Aluminum

U. S. Patent 2,866,713. *Dec.* 30, 1958. *R. P. Allen, assignor to E. I. du Pont de Nemours and Co.*

A lead-free vitreous enamel frit suitable for use as a protective coating on the surface of aluminum and aluminum-rich alloys, having a firing and maturing temperature of between 500° and 580° C. and which consists essentially of

	% by weight
P_2O_5	39.1—48.2
Al_2O_3	20.8—28.1
Na_2O	18.25—22.8
TiO_2	2.4—2.7
B_2O_3	0—8
K_2O	0—15
Li_2O	0—3.5
ZrO_2	0—4

in which the total alkali metal oxide content is between 25% and 35%, and the total of all said ingredients constitutes at least 90% of said frit.

Pleated Buffing Wheel

U. S. Patent 2,867,062. *Jan.* 6, 1959. *F. E. Hendrickson, assignor to Murray Ireland*

In a buffing wheel, a circular hub having an axial opening therein for mounting it on a shaft, mutually spaced spokes extending outwardly radially from the periphery of said hub, a buffing annulus on said hub having a peripheral work surface and comprised of a plurality of multi-ply elements of fabric material carried by said spokes, a medial pleat in each element, said elements each being folded along a line perpendicular to the pleat therein so as to define a semi-circular shape having a greater number of material thickness in its medial pleated portion than at its end portions.

Degreaser

U. S. Patent 2,867,225. *Jan.* 6, 1959. *E. R. Zademach, C. J. Auger and I. L. Lans, assignors to Metalwash Machinery Co.*

In a degreaser, a main tank having unobstructed side walls and an open top, a side tank offset from said main tank, condenser means at the top of said tank, partition means sealing off said side tank below said condenser means from said tank, said partition means including a drain plate below said condenser means, water separator means within said side tank below said drain plate, said drain plate opening on to said water separator means, pipe means connecting said side tank with said main tank, said condenser means including a vertically disposed helically wound continuous coil of tubing extending substantially the full horizontal dimension of said side tank, an outlet and inlet mounted in the end wall of said side tank, and means for releasably connecting the inlet and outlet of said tubing to said inlet and outlet.

Spray Gun

U. S. Patent 2,867,476. *Jan.* 6, 1959. *J. F. Siefen*

A spray gun of the class described.

Pickling Aluminum

U. S. Patent 2,867,514. *Jan.* 6, 1959. *N. J. Newhard, Jr. and J. H. Thirsk, assignors to Amchem Products, Inc.*

The method of treating an aluminum surface which consists in subjecting the surface to the action of an aqueous acid solution consisting essentially of hexavalent chromium and fluoride, the quantity of hexavalent chromium being from 10 to 100 grams per liter and the quantity of fluoride being sufficient to give a bath activity at least as great as a solution of:

Chromic acid	grams	30
48.8% hydrofluoric acid	milliliters	0.25

Water to make 1 liter.

but having no more activity than a solution of:

Chromic acid	grams	30
48.8% hydrofluoric acid	milliliters	1

Water, to make 1 liter.

the pH of the solution being between 0.5 and 1.0, and the treatment being continued until the surface is deoxidized.

Waste Pickle Treatment

U. S. Patent 2,867,524. *Jan.* 6, 1959. *M. C. Chang, assignor to Crucible Steel Co. of America*

In the pickling of steel, a cyclic process for regenerating the acid values in the spent liquor from the pickling both and producing finely divided iron powder therefrom, with consumption of a gaseous reducing agent only, which comprises the steps of contact-

ing the ferrous sulfate and sulfuric acid containing spent pickle liquor with a gaseous chlorinating agent selected from the group consisting of hydrogen chloride, carbonyl chloride and mixtures thereof to form additional sulfuric acid and a ferrous chloride precipitate, separating the ferrous chloride precipitate from the more concentrated sulfuric acid solution, recirculating the acid solution to the pickling bath, contacting the separated ferrous chloride precipitate with a gaseous reducing agent selected from the group consisting of hydrogen, carbon monoxide, coke oven gas and mixtures of hydrogen and carbon monoxide between about 900 and 1300° F. to form iron powder and the aforementioned gaseous chlorinating agent, recirculating the chlorinating agent to the pickle liquor treating step, and removing the iron powder from the system.

Gas Plating

U. S. Patent 2,867,546. *Jan.* 6, 1959. *W. M. MacNevin, assignor to The Commonwealth Engineering Co. of Ohio*

A method of aluminum plating material which comprises establishing a source of dry inert gas free of oxygen and moisture, enclosing said material to be plated in a plating chamber filled with said inert gas, introducing aluminum triisobutyl into said plating chamber and in contact with said material, and heating said material to a temperature to cause decomposition of said aluminum triisobutyl and deposition of aluminum onto the surface of said material.

Gas Plating

U. S. Patent 2,867,552. *Jan.* 6, 1959. *H. J. Homer, assignor to The Commonwealth Engineering Co. of Ohio*

A method of producing an electrical conductor composite body having a core of electrically non-conductive filaments.

Belt Polisher

U. S. Patent 2,867,949. *Jan.* 13, 1959. *H. A. Meyer*

In machinery for treating the surface of cylindrical metal stock, the combination including replenishable abrading means and means to produce relative revoluble movement between stock to be treated and said abrading means with the cylindrical surface of the stock to revolubly score said surface and to intermittently actuate said replenishable abrading means step-by-step during said relative revoluble motion between the stock and the abrading means.

Paint Coating Machine

U. S. Patent 2,868,162. *Jan.* 13, 1959. *W. M. Knain, assignor to General Electric Co.*

An endless belt paint coating machine for long, cylindrical work pieces which are transversely fed into the machine in close side-by-side relation.

Apparatus for Coating Cavities

U. S. Patent 2,868,163. *Jan.* 13, 1959. *G. M. Boyd, assignor to General Electric Co.*

A spraying apparatus comprising an upright shaft, a carriage, means mounting said carriage on said shaft for sliding movement therealong, a plurality of elongated upright spray guns, means mounting said guns on said carriage for movement therewith, drive means connected to said shaft for rotating the same, and means for reciprocating said carriage along said shaft.

Spray Gun

U. S. Patent 2,868,166. *Jan.* 13, 1959. *K. Brechenmacher*

A spray gun having a spray nozzle, a ring-shaped reflector curved forward on its inner edge and mounted on said spray gun so as to surround said spray nozzle, and a ring-shaped infra-red radiator mounted in front of the reflector surface and in a plane at right angles the axis of the spray nozzle.

Spray System

U. S. Patent 2,868,584. *Jan.* 13, 1959. *D. G. Faust, assignor to C. A. Norgren Co.*

An adjustable, multiple spray system comprising a first conduit for air under an independently controlled pressure, a second conduit for liquid under an independently controlled pressure, and spaced mixing means interconnecting said first and second conduits at intervals along their extent for admixing a portion of the flows therethrough.

Spray Gun

U. S. Patent 2,868,585. *Jan.* 13, 1959. *P. Esser*

A spray gun adapted to engage with the open end of a fluid container comprising, an elongated gun body formed at one end with a raised portion having a mixture receiving chamber whose axis extends parallel to said elongated gun body.

Aluminum Conversion Coating

U. S. Patent 2,868,679. *Jan.* 13, 1959. *G. H. Pimbley, assignor to Turco Products, Inc.*

An aqueous acid bath for applying a coating to surfaces of objects of aluminum and its alloys, which comprises as essential active ingredients effective amounts of lithium as a cation, an anion containing an element in group VI-A of the periodic table and a fluorine-containing anion.

Pickling and Coating Stainless Steel

U. S. Patent 2,868,680. *Jan.* 13, 1959. *J. A. Henricks, assignor to Devex Corp.*

The process of pickling and coating stainless steel in the same bath comprising the steps of immersing said work in a 12 to 30 per cent acid pickling bath containing about 5 to 100 pounds of sodium chloride and from 1 to 10 pounds per 100 gallons of solution of an activator comprising an alkali salt containing oxygen and sulfur with a valence below six, and removing said work and rinsing in hot water.

Conversion Coating

U. S. Patent 2,868,682. *Jan.* 13, 1959. *G. W. Dell, assignor to Parker Rust Proof Co.*

An aqueous acidic solution for producing corrosion-resistant and paint-base coatings on metallic surfaces consisting essentially of water, at least one compound containing hexavalent chromium, at least one compound containing the fluoride radical, and at least one condensed phosphate compound which yields the condensed phosphate radical in solution and in which the mole ratio of cationic oxides to anionic oxides is greater than 0 and less than 3, said condensed phosphate compound being present in amounts up to about 0.5% by weight calculated as condensed phosphate of sodium compound.

Electropolishing Bath

U. S. Patent 2,868,705. *Jan.* 13, 1959. *J. J. Baier and E. Wodetzky*

An electrolyte for use in anodically treating metal surfaces, consisting essentially of phosphoric acid and chromic acid and containing 0.7 to 2.7% by weight of sulfuric acid and 0.004 to 0.014% of hydrofluoric acid.

Feed Device for Continuous Plating Barrel

U. S. Patent 2,868,709. *Jan.* 13, 1959. *R. G. Bikales, assignor to Metal and Thermit Corp.*

In a plating machine especially adapted for chromium plating from a chromic acid type solution comprising a tank adapted to hold the plating solution at a predetermined solution level therein, a horizontal rotatable metallic barrel adapted to be partly immersed in said solution and with which work articles therein may make electrical contact and one end of said barrel adapted to receive work articles to be plated and the other end to discharge said articles, the combination of means adapted to move work pieces longitudinally of said barrel comprising a plurality of plates arranged on edge in a longitudinal row on the inside wall of said barrel with each plate angularly disposed in the same direction to the longitudinal line of said row of plates and each plate disposed relative to the other plates so that any plane at right angles to the longitudinal axis of said cylinder between the leading edge of one end plate and the trailing edge of the other end plate will intersect at least one plate.

Centrifugal Abrasive Blasting

U. S. Patent 2,869,289. *Jan.* 20, 1959. *C. M. Gossard, assignor to Pangborn Corp.*

An abrasive throwing vane comprising an elongated base adapted to be connected to a centrifugal throwing wheel, a blade connected to said base, said blade extending the entire length of said base and having an extension which extends beyond the corresponding end of said base.

Dual Abrasive Blast Nozzle

U. S. Patent 2,869,290. *Jan.* 20, 1959. *R. A. Stokes*

A dual abrasive blast nozzle comprising an elongated hollow body, terminating at the opposite end in an enlarged head of generally oval shape.

Electroforming Process

U. S. Patent 2,870,709. *Jan.* 27, 1959. *E. D. Boelter, Jr., assignor to E. I. du Pont de Nemours and Co.*

In a jet perforator comprising a shaped charge, means for detonating said shaped charge, a container substantially surrounding the shaped charge and a cavity in the base of the same, a lining in said cavity comprising a substantially stain-free copper cone produced by electrodepositing copper from an alkaline copper cyanide bath containing 50-1000 p.p.m. of an inorganic selenide.

Electroforming Wave Guides

U. S. Patent 2,870,524. *Jan.* 27, 1959. *J. A. C. Kinnear, assignor to Elliott Brothers (London) Ltd.*

A method of manufacturing a waveguide component.

ABSTRACTS

Hard Chromium Plating of Engineering Parts

P. Morisset: Paper read at the 6th International Congress of Engineering Fabrication, Paris.

The improvement in resistance to wear of mechanical parts by increase of the surface hardness, is the crucial advantage obtained from hard chromium plating in engineering practice. The author presented a detailed study of modern techniques of hard chromium plating, with examples of the coating of various engineering parts, and statistical results in practice which have been obtained in France. Various applications were considered.

Chomium Plating of I. C. Engine Parts

A service test which recently was conducted by the French S.N.C.F. firm, served to indicate the remarkable hold-up in service of plated piston rings. Five large diesel engines driving auto-rail cars, each engine comprising 12 cylinders, were equipped as follows: On each engine six cylinders were equipped with the head piston ring chromium plated.

The chromium deposit applied was of the order of about 0.12 mm. on the radius, with 0.03 mm. of surface thickness transformed into porous chromium, facilitating the running-in of the engine. After 100,000 km. it was confirmed that the diametrical wear of the cylinder sleeves at the upper-dead-center position of the piston was consistently almost 4 times as low for the cylinders with the plated head piston ring. It was likewise confirmed that the sectional wear of the plated head piston ring was 7 times lower than that of the non-plated head piston rings.

Current practice for the sealing rings of diesel engines consists of a hard chromium deposit of 0.10 to 0.12 mm. in thickness, which is then dimensionally adjusted and lapped. The sealing rings chromed in this manner are of diameter ranging from 80 to 750 mm. (3-30″). It was found that this plating treatment allows trucks to run up to 10,000 miles without overhaul and without abnormal wear of the cylinder sleeves.

Chromating Steel Strip for Corrosion Resistance

W. Rausch: *Stahl und Eisen*, **79**, No. 6, 351-352.

In recent years attempts have been made to improve the corrosion resistance of steel sheet and strip, particularly for the production of packaging containers, by a simple means other than the usual coating processes. Chromic acid solutions coat the steel with an adherent fluid film which is subsequently dried out at elevated temperature. In this treatment there is obtained a coating which is about 0.1 to 1 micron in thickness and which is almost invisible.

This coating has the noteworthy characteristic of being completely water-repellant; further, it is completely insoluble in water as well as in most solvents. The chemical structure of the coating has not yet been fully explained, because of its complicated structure. No difficulties are encountered in welding the treated sheet or in joining to thermoplastics. Before soldering, however, the coating must be removed, which is best done mechanically. To avoid this drawback the solder areas can be masked off during the treatment, to avoid coating at these places.

As regards corrosion-resistance, considerable differences exist between the chromating and the alkali-phosphate coating processes (light phosphating). For outdoor exposure, the iron phosphate coatings, particularly when they have been given an after-rinse in concentrated dichromate solutions, are somewhat superior. The explanation for this is that during condensation, water drops form on the water-repellant chromate coatings, which gives rise to a pin-pointed, localized concentrated attack. On the other hand, with the hydrophilic iron phosphate coatings, under the same test conditions, a uniform water-wetting effect occurs

over the entire surface. Further, when the relative humidity of the surrounding atmosphere drops, the iron phosphate coatings dry out more quickly on account of the greater evaporation surface available.

Under accelerated corrosion test conditions as with the salt-spray test or with tropical testing, the iron phosphate coatings, however, show themselves to be clearly inferior.

These chromate, hydrophobic coatings can be lacquered without any trouble, just as the phosphate coatings.

The application of hydrophobic cover coatings requires a steel sheet surface well prepared and wettable with water. In some cases it can be an advantage to activate and pickle the steel surface before wetting with the chromating solution. The time-absorbing stage in the overall treatment schedule is the best treatment of the coating, which can be from 4 to 120 seconds, depending on the furnace temperature and the process used.

Practical Aspects of Electropolishing Steel and Steel Alloys

S. Gruettner: *Metallwarenindustrie und Galvanotechnik*; **49**, #2, 58-62.

The author gives details of practical experience in electropolishing iron, steel, alloy steels and the stainless steels, with the phosphoric-sulfuric acid bath. This type of electropolishing bath has found the widest application in practice, because it is relatively insensitive to impurities, and is uniform in its polishing action, particularly with continual use. It is also of broad scope in its application to the varying types of steel and steel alloys that can be treated in the bath.

The best bath has been shown by experience to be a mixture consisting of about 65 volume % phosphoric acid and 35% sulphuric acid. A small amount of water is necessary to give the requisite electrical conductivity of the bath. The most favorable working conditions are as follows:

Current density ..... 15 to 25 amp./dm.^{2}
Voltage 4-5
Temperature ..... 70-72°C.

The parts to be polished must be free from grease and scale oxide. Electrolytic cleaning is not necessary; solvent degreasing will be found sufficient. In every case the ware must be passed into the bath dry, so as not to increase the water content.

Varying conditions are encountered in electropolishing steels with 12 to 15% chromium. Very good results have been obtained by the author by raising the bath temperature to 80-85° C. and the applied voltage to 5-6 volts. With these values, the current density is also raised to about 1½ times the previous value. The metal-removing effect is raised accordingly, so that the polishing time can be shortened. With ware that has been given a prior mechanical polish as, for example, with surgical instruments, an electropolishing time of only a few minutes is needed.

In most cases, agitation is necessary, at about 60-90 to-and-fro movements per minute. Very firm contact of the ware with the racks and the anode bars is required with this agitation.

The electropolished ware should be removed from the bath with current still on, so that possibility of any etching action can be avoided. Difficulties can occur during the rinsing of electropolished stainless steel because the strong acids adhering on the ware become diluted and act aggressively. These residual acids, therefore, must be removed from the ware as quickly as possible during the rinsing.

The Pentaerythritol Alkyd and Modified Alkyd Finishes

G. Brochard: *Revue des Produits Chimiques*, **62**, #1257, 8-9.

When pentaerythritol is used in place of glycerine for the preparation of an alkyd, the resins obtained have a higher viscosity, an improved brilliance and an increased resistance to water and to alkalies. It is generally agreed that this increase in properties results from an increase of the functionality by the replacement of a trihydric alcohol by an alcohol possessing 4 or more OH groups.

A further advantage is that it is possible to modify the properties of the resin products obtained in this manner over a wide range, by acting on the choice of the acid constituents and the proportions of the reagents employed. Thus, the alkyds can be classified into long, medium, and short-in-oil products, according to whether the oil content is respectively 60-80%, 45-60%, or less than 45%. It is this proportion which determines the hardening during baking, the speed of drying, the hardness, and the flexibility of the films obtained. The products short in oil, thicken-up rapidly, dry more rapidly, and give relatively brittle films. The alkyds long in oil, are more compatible with oils, less viscous, dry more slowly, and give more flexible films.

Phthalic anhydride is the dibasic acid usually utilized for the preparation of the alkyd resins based on pentaerythritol, because of its favorable price and the qualities it confers on the resin. Isophthalic acid is also used often, likewise terephthalic acid, tetrahydrophthalic acid, maleic anhydride, and various other dibasic acids. Each of these acids confers specific characteristics on the resins such as greater viscosity and higher rapidity of drying with isophthalic acid, hard and durable resins and finishes with maleic acid, flexible products with succinic, adipic, sebacic acids, and soft films with itaconic acid.

With the modified alkyds based on pentaerythritol, styrene, and its homologue, vinyltoluene, are currently the most utilized products for the preparation of alkyds modified by the vinyl resins, with the object of improving the speed of drying, brilliance, color conservation, improving chemical resistance and durability of the resins. These modified resins are obtained, for example, by reacting the styrenated fatty acids of a drying oil with pentaerythritol and a dibasic acid or by copolymerizing an alkyd with styrene.

Among the other vinyl derivatives that have been utilized with the same objective, there can be mentioned acrylic nitrile, the substituted styrenes or their mixture — alpha-methyl styrene, etc. Similarly, alkyds modified by the phenolic resins give finishes which are either air-drying or dry by baking. For this purpose, phenol-formaldehyde resins are used and also the epoxy-phenolic ethers.

The alkyd resins, modified by the amine resins, are obtained by the combination of alkyd resins prepared by starting with non-drying oils and urea-formaldehyde resins or the melamine-formaldehyde product. This modifying treatment has the particular advantage of hardening the resins and of obtaining finishes which have a high scratch resistance.

Finally, there is the condensation of the silicone resins with the pentaerythritol alkyds, producing finishes which show an enhanced resistance to heat and to chemicals, compared with the non-treated alkyds; these finishes also have a better hardness and greater adhesion than the silicone resins.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT
FOR THE METAL FINISHING INDUSTRIES

Roll-Top Zinc Anodes

Allied Research Products, Inc., Dept. MF, 4004 E. Monument St., Baltimore 5, Md.

The "Roll-Top" zinc anode is cast in a modified oval form. This shape is claimed to provide approximately 20% more surface area than standard ball anodes, yet allow the anode to roll easily into a curved hanger basket or backfeed chute for automatics. Because of the shape, there is no problem of hang-up in the containers.

Bright Nickel Process

Electro Chemical Supplies Div., Seymour Mfg. Co., Dept. MF, Franklin St., Seymour, Conn.

A new, economical, bright nickel plating process called "Hi-Thro" is claimed to have higher throwing power, and to produce a cleaner, whiter, and brighter deposit, completely free from the black deposits normally encountered in low density areas. The result is improved corrosion resistance and a brighter, more durable final finish.

The fast, economical process offers a number of important production advantages, among them a wide pH range (2.8 to 4.5); excellent ductility; exceptionally wide current density and temperature range; quick brightness-building qualities; excellent leveling characteristics; good tolerance to impurities; and high receptivity to chromium and other plating. It eliminates the need for special activating treatments normally required before chromium plating. No ventilation is required at normal temperatures since there are no toxic or unpleasant fumes.

Interested parties are invited to submit samples to the company for bright nickel plating with the new solution. Test samples of the solution are available on request.

Epoxy Enamels Stripper

Enthone, Inc., Dept. MF, New Haven, Conn.

A cold, chlorinated liquid stripper for epoxy enamels can be diluted with up to 20 parts by volume of water. The new dilutable product, called Stripper S-26, performs all of the functions of presently employed expensive cold chlorinated strippers which must be used full strength. With the new product, stripping costs are substantially reduced and evaporation losses minimized without sacrificing the advantages of room temperature stripping.

The product is acidic in nature and non-flammable. It is used as concentrations of 1 part stripper to from 4 to 20 parts of water by volume. It is operated at room temperature and acts by wrinkling and detaching the enamel from the basis metal. New, hard-to-strip epoxy coatings are removed from most metals including steel, aluminum, copper, brass and zinc die castings. The product is also effective for stripping of plastisol coatings from racks.

The stripping solution is readily maintained by periodic additions. Since it wrinkles the coating instead of dissolving it, it does not become contaminated with dissolved enamel and has long life. Although chlorinated solvents are excellent bases for paint stripper formulations, they will separate out immediately when mixed with water. By the use of special additives, the manufacturer has made it possible to form stable, clear mixtures of chlorinated solvents and water. The made-up cost of such mixtures is only a small fraction of the cost of undilutable chlorinated strippers.

Zinc Brighteners

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

Zincalume process produces distinct brilliant deposits in both still and barrel equipment. The addition agent used in the bath is effective without a subsequent bright dip, and permits the operation of the process over a wide current density range. Bright deposits are produced at either high or low current densities with slight changes in composition or operating conditions. Maintenance of the bath is simple.

The bright deposit can be bright dipped in nitric acid as well as chromate conversion bright dips. Because of its exceptional brilliance and corrosion protection the new process has wide applications in the hardware trade and other fields.

Vapor Degreaser

King Co., Inc., Dept. MF, 155 Carteret Road, Port Reading, N. J.

A new degreasing machine combines the advantages of chemical vapor cleaning with portability and simplicity. The introduction of an electrical thermal switch does away with the cumbersome and confining water piping. If any electrical failure should occur in the machine, it is turned off automatically to insure safety.

The portability of this new vapor cleaner has been increased by placing it on 4" wheels and furnishing it with a plug-in cord. Its location is depend-

You get your best buy with
NEW SHAPE H-VW-M NICKEL ANODES

Designed to Save You Money. New H-VW-M Nickel Anodes retain efficient elliptical shape, but are made thicker to give you more weight per inch . . . 1.32 lbs. Standard anode bags fit . . . less scrap loss per anode too. Result: longer runs that save labor.

Pre-Cleaned, Ready for Use . . . H-VW-M Nickel Anodes are detergent-washed, reach you free of chips and grease . . . wrapped in waterproof, greaseproof paper. And H-VW-M supplies titanium hooks as well as monel.

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ent only on the location of the nearest electrical outlet.

Other advantages of this degreaser include: optional circulating spray; simplicity of operation; a special drain plug and angulated plate which simplifies solvent recovery; dual purpose handles (used for moving the machine or for supporting the machine covers to make a work bench); low maintenance cost; and easy part replacement. A circuitry of all wires in the degreaser is enclosed with every unit.

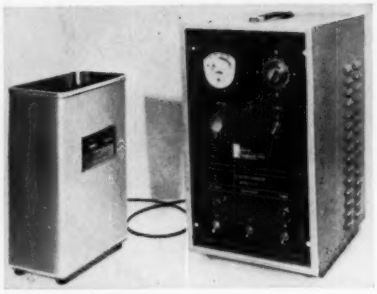
The degreaser is available in five models, ranging from 115 volts a.c. and 1500 watts to 220 volts a.c. and 5000 watts, in either single or three phase. 440 volt models are available upon request.

Ultrasonic Cleaner

National Ultrasonic Corp., Dept. MF, 111 Montgomery Ave., Irvington, N. J.

An ultrasonic cleaner for applications in which high energy density is required. Model 20 features a 2-gallon tank made of heavy-gauge polished stainless steel. Tank is 9" long, 6" wide and 10" deep. 44½% of the bottom of this tank is covered with driving elements. Actual radiating surface is 24 square inches.

The generator, 115 volts AC single-phase 60 cycle, is designed for continuous operation. It delivers an average power output of 125 watts and produces peaks of 500 watts. Features include 0-60 minute timer, one tube



oscillator, provision for remote control of equipment, front panel switching which permits a choice of either of two transducers and circuit breaker and 3-wire ground protection. Unit can be adjusted to available line voltage.

Plastic Coating Process

Kaybar Inc., Dept. MF, Birmingham, Mich.

New plastic materials and an improved processing system have been developed for the plastic coating of fabricated steel, wood, fiber, paperboard or other materials. The new coating is an easy-handling, spray-on vinyl formula which bonds securely to the basis material for the life of the product. Coatings of 0.003 to 0.012 inches, when used over readily available pre-textured steel, will accurately retain the detail of the textured pattern, resulting in a rich appearing, luxurious feeling finish that stubbornly resists abrasion and wear.

It can be easily applied over prefabricated assemblies, thus leaving no open edges or unsightly weld-burns. The coating may be applied only to the finished assembly or part, thus avoiding expensive, contaminated scrap loss. The material is available in a full range of standard or matched colors. It has excellent flexing strength as well as contributing desirable sound deadening and insulating qualities.

The above manufacturer has modern facilities for the application of the new coatings, electrostatically, at their plant, or manufacturers will be licensed to use the materials and process in their own plants.

Paint Stripper

Turco Products, Inc., Dept. MF, 24600 S. Main St., Wilmington, Calif.

A new brush-on, water-rinseable paint remover remains wet and workable for a day or longer and thus strips deeper and more completely, it is

claimed. A single coating of the new material, Turco 4377B, is sufficient, in most cases, to completely remove up to ten layers of unwanted paint. The product is safe and noncorrosive on all common metals. It effectively and completely removes a wide range of finishes (paint, varnish, baked varnish, lacquer, zinc chromate primer, baked enamel, automobile synthetic enamel, air-dry synthetic enamel, baked urea alkyd coatings, etc.) under the most adverse weather conditions in a simple brush-on, rinse-off operation. No surface agitation is normally required. Since it automatically thickens when standing and becomes thin when agitated, it clings to vertical and overhanging as well as to horizontal surfaces.

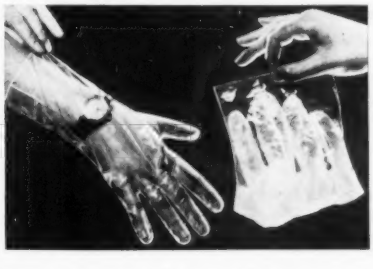
The stripper operates on the bond-release principle, i.e., quickly penetrating solvents plunge through multiple paint coatings to the basis metal, where they exert their loosening and lifting powers to break the bond between paint and metal. The paint film is then completely removed in sheets at any convenient time with a high pressure water rinse, leaving a clean, film-free surface that is ready for immediate repainting, without need for after-neutralization.

Disposable Gloves

Wilson Rubber Co., Industrial Division, Dept. MF, 1200 Garfield Ave., S.W., Canton 6, Ohio.

New Wil-Gard clear polyethylene, five-fingered disposable gloves offer convenient hand protection. Worn on either hand and pre-powdered with Bio-Sorb, they are extremely easy to slip on or strip off. Lightweight, flexible and moisture-proof, these Poly-D gloves protect hands from scores of chemicals, powders, and resins. They also safeguard precision parts against perspiration corrosion.

The gloves feature strong, heat-welded seams with super-smooth edges that provide excellent resistance to snagging and tearing without sacrificing manual dexterity and touch-sensitivity. Available in medium and heavy weights, the gloves are packed 144 to a box with paper spacers, in small, medium or large sizes.



Aluminum Paint

Tropical Paint Co., Dept. MF, Cleveland 2, Ohio.

Relief from overspray, a paint problem that has frustrated contractors for years, is promised today by a new, more durable, aluminum paint. Called Dri-Spray Aluminum, the new product is intended to banish the need for drop cloths, or other protective devices on surfaces near a painting area. The overspray dries almost instantly in the air. Any dried aluminum paint particles landing on a surface adjacent to the area being painted then can be wiped up, or brushed off, just like dust.

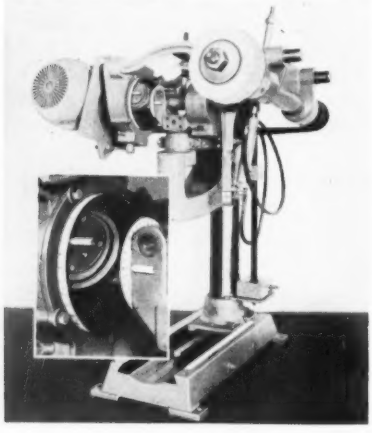
Ideal for both indoor and outdoor metal, masonry, wood and plaster, the paint should always be applied with a spray. On a smooth surface, a gallon will cover about 2000 square feet.

Position Indicator for Polishing and Buffing Heads

Murray-Way Corp., Dept. MF, Birmingham, Mich.

The above manufacturer's buffing and polishing heads are now available with numbered dials which take the guesswork out of head positioning. Once correct head positions are found

and recorded, heads may be changed and quickly repositioned by use of the dial numbers. Any variation or change in head position appears on the indicator dial.



Particularly important, equipment can now be adjusted for work changeover in a fraction of the time previously required.

Steam Cleaning Hose

Manhattan Rubber Div., Raybestos-Manhattan, Inc., Dept. MF, Passaic, N. J.

Steam cleaning is made safer with #200 BW steam hose, featuring braided steel wire burst protection, and designed for use to 200 lb. saturated steam pressure at 388°F.

Strength and dependability are employed throughout the construction.

Two braids of high tensile, multiple-end, non-corrosive steel wire are stretched over an asbestos covered innertube of thick heat resisting rubber. Special butyl cover for maximum heat and weather resistance. Minimum elongation and contraction under pressure, and longer life are also claimed for this construction.

The hose is available in sizes from ½″ to 2″, and is made also in #150 BW type for 150 lb. saturated steam pressure.

Spray Nozzles

Spraying Systems Co., Dept. MF, 3245 Randolph St., Bellwood, Ill.

A new line of atomizing nozzles is made of hard rubber for corrosive liquid spraying applications. The nozzles produce a hollow cone spray pattern and atomization is accomplished through hydraulic pressure alone. A range of capacities is offered, from one to twenty-six gal./hr., based on operation at 40 psi. All parts of the nozzle are made of hard rubber, offering maximum resistance to acids and related corrosive liquids. These nozzles are identified as ¼-NR atomizing nozzles.

Anode Ball Baskets

Wiretex Mfg. Co., Inc., Dept. MF, 40 Mason St., Bridgeport, Conn.

Standard models of a full line of anode ball baskets, used for zinc plating are of steel, 12″ to 36″ in length, 2⅛″ diam., and have a standard 5″ hook. The basket is designed to hold two-inch diam. balls. A sturdy hook supports the unit during immersion. Baskets can be altered in diameter or length according to individual specifications.

Readily available in steel and other alloys and metals at low cost, the baskets have become standard items in many metal finishing shops.

Aluminum Treatments

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

Alcond DX-100 is recommended for desmutting aluminum that has been etched in a caustic etchant, and deoxidizing to remove surface oxides from aluminum prior to anodizing or conversion coating. It may also be used for preparing aluminum surfaces for spotwelding where an extremely low surface resistance is required. It can be operated over wide ranges. Operations employing this product should be performed in tanks lined with polyvinyl coatings or made of stainless steel.

A new aluminum conversion coating process, Chem-Rite A-22, is an easy-to-use, inexpensive chromate surface conversion coating treatment. For ease of handling it is supplied as a liquid concentrate.

The product solves two important problems, it is claimed. It eliminates messy, hard-to-dissolve powdered materials and it eliminates chemicals wasted by incomplete dissolution. The process offers two important advantages, according to the company; it increases the corrosion resistance of aluminum and it provides an excellent base for paints and other organic coatings.

Solution preparation is simple; add five gallons to 95 gallons of water for 100 gallons of the bath. It is ready for immediate use.

Brush Chem-Rite A-22 is used for parts too large for available dip equipment or for processing parts in quantities so small as not to justify the cost of installing tanks.

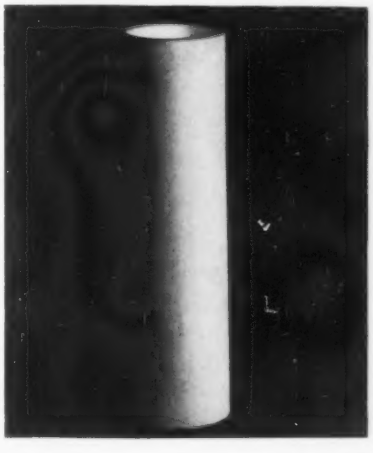
Porous Ceramic Filter Element

Commercial Filters Corp., Dept. MF, 2 Main St., Melrose, Mass.

A new porous ceramic filter element, made from specially formulated glass fused under controlled conditions of temperature and pressure, has exceptionally high resistance to heat, heat shock and chemical attack.

Uniform structure of the ceramic material gives particle retention up to 98% for each rated density. Filters are currently available in 1, 5, 10, 25, 50 and 100 micron particle retention ratings.

Elements are capable of withstanding up to 600 psi differential pressure. They are easily cleaned by simple back-



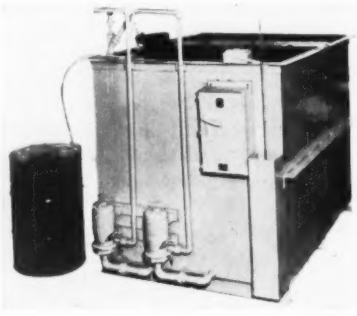
washing with clear water, acid bath or firing at temperatures up to 1800° F. Restored efficiency by these methods is exceptionally high, resulting in unprecedented long life and efficiency.

Filter tubes are available in three sizes — 10″ x 2½″; 20″ x 2½″; 30″ x 2½″. They may also be provided as discs, sheets, and cylinders of other sizes.

Cyanide Waste Treater

George L. Nankervis Co., Dept. MF, 15400 Fullerton Ave., Detroit 27, Michigan.

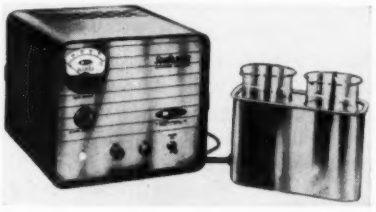
A new low-cost Cyanizer package, Model 6444, for highly efficient treatment and disposal of cyanide wastes from plating operations with sodium hypochlorite, contains a sump tank, baffle tank, pumps and controls. Cyanide wastes are collected in the sump and pumped into a specially designed baffle tank for neutralization with a concentrated solution of sodium hypochlorite. Wastes remain in the baffle tank for treatment of one hour. During this time, sodium hypochlorite solution, automatically metering into the tank, completely neutralizes the waste.



Operation is entirely automatic and continuous. No operator is required. Since the discharge is fully neutralized, it can be dumped into municipal sewer systems with complete safety. The new unit is easily installed and maintained. It has a capacity of 800 gallons per hour and measures 7½ by 5 by 5½ feet. The package is fabricated from ¼ inch steel plate, suitably reinforced and coated with acid-resistant paint. The unit contains two 20 gpm pumps and operates from a 110 volt single phase line.

Ultrasonic Cleaner

Narda Ultrasonics Corp., Dept. MF, 625 Main St., Westbury, N. Y.



The new Series 400 SonBlaster ultrasonically agitates the contents of two glass beakers. It is now possible to wash and rinse parts simultaneously, use two different solutions at the same time, use any chemical, acid, or alkali solvent in glass beakers, or use the stainless steel tank without beakers. It provides an ultrasonic generator, Model G-401, a transducerized ultrasonic tank Model NT-401 and two 400 ml Pyrex glass beakers. Items to be cleaned or processed may be placed in separate beakers or directly in the tank itself.

The units cost $275 including an unconditional two-year guarantee. Generator Model G-402 incorporates a built-in timer, available at only $10 additional.

Infrared Heater

N. J. Thermex Co., Inc., Dept. MF, 533 Bergen St., Harrison, N. J.

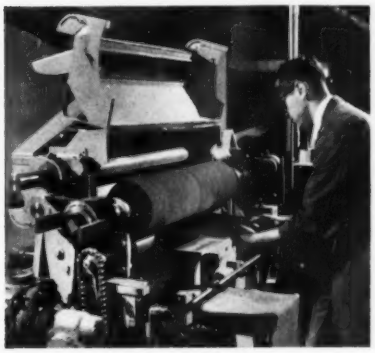
Infralite Add-A-Unit aerial radiant infrared heater system features an element which operates in the highly efficient spectrum of the intermediate infrared radiant wave length range of 1.7 to 3 microns with a peak of 2.2 microns.

This unique element is provided in a reflector housing which is designed to be mounted side by side, end to end or around bends on simple angle iron frames. The Add-A-Unit feature provides a versatility heretofore unknown in aerial heating applications.

Abrasive Wheels

Behr-Manning Co., Dept. MF, Troy, N. Y.

A completely new form of abrasives, wheels and rolls of non-woven nylon fiber with abrasive grain dispersed throughout, appears to offer great promise in finishing and polishing. The new Bear wheels are not designed for stock removal or even for normal grinding or deburring, although their action may be varied by changing the type and size of grit, modifying the resins used, altering the density of the wheel itself, varying the rate and extent of oscillation or changing pressures and speeds. At their most aggressive, the wheels and rolls remain the gentlest of power-driven abrasives.



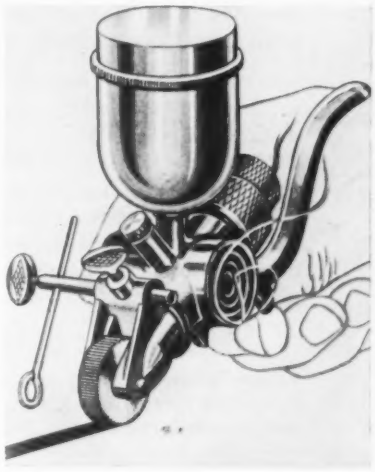
They are made in all normal diameters, in face widths up to 60 in., and in a grit range from 100 to 600. Various abrasives have been employed in early production, though most testing has been done with silicon carbide. Advantages apparent thus far include cool operation which prevents warping of metals or blistering of foil-clad plastic panels; long life; ease of redressing; and light weight.

Engineering tests indicate that the wheels should be run at relatively low speeds — approximately 2600 surface feet per minute. Pressures should be light in order to avoid heating, and the wheels should be oscillated to produce the most consistent overall pattern.

Decorative Paint Striper

Wendell Mfg. Co., Dept. MF, 4234 N. Lincoln Ave., Chicago 18, Ill.

Making painted stripes in widths from 1/32 inch to 2 inches for decorative schemes is a simple matter with the Type W paint striper. According to the manufacturer it is easy to produce clean, straight lines as well as curved and accurate parallel striping for any



number of enamelled, painted or lacquered decorative effects. It is used in production finishing as well as in refinishing.

The tool is held like a fountain pen; a small interchangeable wheel actually "rolls out" the stripe of the desired width. Beveled and V-shaped wheels for striping grooves are available.

Fluidized Bed Coater

Armstrong Products Co., 359 Argonne Road, Warsaw, Ind.

The Vibro-Fluidizer, for coating objects by the fluidized-bed process, consists of a vessel with a porous ceramic floor, for containing the powdered resinous material to be used for dip

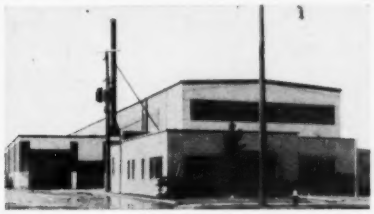
coating. This vessel is mounted above and integral with an encased energizing unit, consisting of an adjustable air turbine driven vibratory unit from which the propelling air (or gas) passes up through a replaceable desiccant cartridge and through the ceramic floor of the vessel. The combination of aeration and vibration gives the powdered coating material the appearance of a boiling liquid and makes it easy to dip parts.

The dip-coating process consists of dipping a moderately pre-heated article into powdered coating material for a few seconds. The coating material becomes securely bonded to the part, forming a tough impact and abrasion resistant dielectric hide. Coating material can be choice of colors. Various thicknesses of the coating or hide are possible. No further curing is required.

BUSINESS ITEMS

Allied Research Expands Detroit Facilities

Allied Research Products, Inc. has expanded its Detroit manufacturing facility by acquiring the 20,000 sq. ft. building adjacent to the company's property at 400 Midland Ave.



The new plant will be known as Plant No. 2 and will contain increased office space as well as manufacturing facilities. This move consolidates the equipment manufacturing facilities formerly carried out at the Dix Ave. plant and chemical manufacturing facilities at the Lyndon Ave. plant, both in Detroit. In addition, all of the chemical manufacturing operations that are now carried on at the Baltimore location, will be duplicated at the new Detroit facility to bring better service to the Mid-West. *Bruno Leonelli* is works manager for the Detroit facilities.

DuBois Adds New Plant

DuBois Co., Inc., has opened a new southwest plant and sales office at 8770 South Central Expressway, Dallas Tex.

The building contains over 35,000 square feet of manufacturing space and houses regional offices and laboratory. The laboratory will handle quality control in the plant and special customer problems.

New Sales Representative Appointed by Gumm Chemical

Edward B. Psyck has been named technical representative for Eastern and Central New York State by the *Frederick Gumm Chem. Co. Inc.* His office will be located at 500 Park Ave. in Syracuse, N. Y.

Mr. Psyck has twenty years of experience in the metal finishing field. Pre-

Edward B. Psyck

vious to joining the Gumm organization, he was associated with Electric-Auto-Lite Co., Syracuse, where he was in charge of all metal finishing operations. He has also been associated with Easy Washer Machine Co., Syracuse, and Brown-Lipe-Chapin, Division of General Motors. Mr. Psyck is an officer of the A.E.S., Syracuse Chapter, and a member of the American Society for Metals, and the New York Sewage and Industrial Wastes Association.

Adams Joins Chainveyor Corp.

Chainveyor Corp., Los Angeles, has announced the appointment of *Charles A. Adams* as division manager. He joins the firm after 13 years experience with Mathews Conveyor Corp., where he was assistant sales manager.

In his new position, Mr. Adams will maintain offices in Ellwood City, Pa., and be in charge of activities in the states of Michigan, Ohio, West Virginia, Western New York and Pennsylvania, as well as Eastern Canada.

Process Engineering Incorporates as Prenco Engineering

It has been announced that *Edward Stanek*, has joined the *Process Engineering Co.* of Chicago, a supplier of

Edward Stanek

plating equipment and supplies to the metal finishing and graphic arts fields. Simultaneous with this announcement, the company announced that they would be incorporated under their trade name of Prenco and henceforth will be known as *Prenco Engineering Corp.* Mr. Stanek will serve as president of the new corporation and *Edward Peters* will serve as chairman of the board.

Mr. Stanek attended the University of Illinois and the Illinois Institute of Technology and has served in many positions in the American Electroplaters' Society, including the presidency of the Chicago Branch. He previously was a sales engineer and director of Belke Mfg. Co. He will be responsible for sales activities and customer relations, while Mr. Peters, who attended Rensselaer Polytechnic Institute, will be responsible for engineering and development.

New Facilities for Zolatone

Establishment of a new *Zolatone Process Inc.* factory sales office and

warehouse in San Francisco, Calif., has been announced by the paints and coatings manufacturing firm. Located at 1230 Howard St. in the bay city, the new branch will serve as district office and warehouse for the complete line of products.

The new facility will be under the direction of *Jay J. Wimberly* as manager. He formerly served as sales engineer in the main headquarters plant in Los Angeles.

Sel-Rex Appoints Walczyk

Walter H. Walczyk

Walter H. Walczyk, formerly chief chemical engineer, Remington Rand Univac—engineering development section—has been appointed Western sales representative by *Sel-Rex Corp.*, Nutley, N. J., manufacturers of precious metals plating processes, plating equipment and supplies. According to the announcement, Mr. Walczyk will make his headquarters at the firm's Los Angeles office at 11168 Santa Monica Blvd., until arrangements have been completed for larger quarters to house the anticipated expansion of service to this area.

At Remington Rand Univac, Mr. Walczyk was responsible for the develcpment and installation of facilities for electroplating and finishing printed circuit boards, electronic memory devices and information storage tapes.

Considered to be an authority on printed circuit development and manufacturing processes, Mr. Walczyk was also associated with the Specialty Electronic Components Department at General Electric where he was responsible for all plating and finishing procurement and equipment applications for the manufacture of printed circuits and similar products. His twenty-five years' experience includes positions with executive and technical responsibilities with International Harvester and Weedesport Mfg. Co.

Appointments at Industrial Filter

Industrial Filter & Pump Mfg. Co. has appointed *Henry Schmidt, Jr.* as director of research and development. During his five years of service with the company as a development engineer, Mr. Schmidt has been granted a number of U. S. patents. He is a graduate of Kings Point Merchant Marine Academy and has served as a lubrica-

Henry Schmidt, Jr.

Stanley C. Clements

Clay Riley

tion engineer with the American Brass Co., Kenosha, Wis.

Stanley C. Clements has been appointed director of production engineering. With the firm twelve years, he received his Bachelor of Science in Mechanical Engineering from Chicago Tech. College.

During World War II, Clements completed 73 missions with the Air Force in the European Theater—where he won the Distinguished Flying Cross and Air Medal, both with clusters.

Also announced is the appointment of *Clay Riley* as director of technical service.

Riley received his Bachelor of Science degree in Electrical Engineering in 1942 from Rose Polytechnic Institute. Prior to coming with the company, he served as plant engineer for Hardy Mfg. Co., in Union City, Ind., and at Diamond Chain Co., Indianapolis Ind. as a maintenance foreman. His previous post at Industrial was as a research engineer.

Techline Names Taylor Regional Manager

Appointment of *Richard D. Taylor*, 966 Sandra Drive, Phoenix, N. Y., as regional manager for the Eastern Division of Techline Division of *Wheelabrator Corp.*, Vicksburg, Michigan, has been announced recently.

Mr. Taylor, former Buffalo sales representative, will supervise the following territories: Cleveland, Cincinnati, Buffalo, New England States, Metropolitan New York, and Philadelphia.

Belgian Plant to Produce Pittsburgh Paints

The Belgian paint firm of *J. G. de Coninck & Fils S.A.* has concluded an agreement with *Pittsburgh Plate Glass International S.A.*, a subsidiary of *Pittsburgh Plate Glass Co.*, to establish a special division for manufacture of the world-famous line of Pittsburgh paints and Ditzler automotive finishes in the Benelux countries. The de Coninck firm is located at Merxem, a suburb of Antwerp, Belgium, and is one of the leading Belgian paint companies.

National Lacquer and Paint Appoints Representative

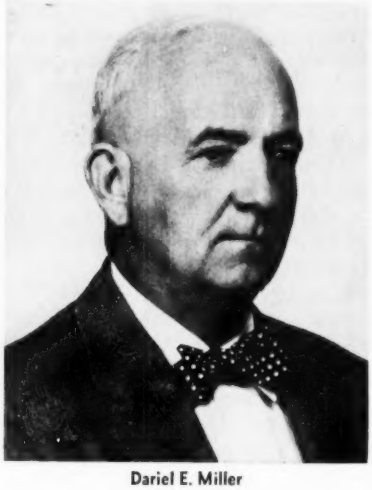
Frank Ettner has been appointed technical sales representative for *National Lacquer & Paint Co.*, manufacturers of automotive, industrial, architectural and specialty finishes.

Mr. Ettner, who will be in charge of sales to the plastic industry, brings to the firm over fifteen years of valuable experience.

Kelite Appointments

Dariel E. Miller and *Ralph J. Goodwin* have been appointed district sales managers for *Kelite Corp.*, manufacturer of industrial chemical compositions and equipment.

Mr. Miller has had more than 17 years of chemical research service and sales experience. In research, he specialized in the field of phosphate chemistry. For 11 years, he served as



Dariel E. Miller

Ralph J. Goodwin

Fred J. Baechtold, Jr.

chemist and senior research chemist for the firm, and some of his work has led to the development of product and process patents. He will be responsible for sales in the company's San Francisco District.

For the past 2½ years, Mr. Goodwin has served as technical sales and service representative for the company. He will be responsible for sales in the Chicago District.

Name Newbold, Wills to Honeywell Posts

William F. Newbold has been appointed director of research for the Brown Instruments Division of *Minneapolis-Honeywell Regulator Co.* He succeeds *Walter P. Wills*, director since 1955, who has been named technical advisor to the director of engineering, a new post.

A native of Philadelphia, Newbold was graduated from Princeton University and joined the company in 1948, serving successively as a research engineer, assistant to the director of research, section head, and assistant research director.

Wills, also a native of Philadelphia, was graduated from Lehigh University. He has been with the firm since 1936, first as a research engineer and then as manager of research and development before becoming director of research in 1955.

Dixon Sintaloy, Inc. Promotes Baechtold

The appointment of *Fred J. Baechtold, Jr.* to supervisor of Eastern Sales Division has been announced by *Dixon Sintaloy, Inc.*, Stamford, Conn., manufacturers and producers of powder metallurgy parts and components.

Mr. Baechtold has been with the company since its establishment in Stamford in 1952. Previous to his present sales post, he was in charge of estimating and cost analysis. A mechanical engineering graduate of Stevens Institute, Mr. Baechtold has also held various engineering assignments in tool and parts design and development with the company as well as its parent organization, The Joseph Dixon Crucible Co.

Sales Executive Appointed by Metal & Thermit

The appointment of *H. W. Buchanan* as manager, General Sales Department, has been announced by *Metal & Thermit Corp.* He will be responsible for the firm's direct selling and distribution components, and will supervise the company's regional man-

H. W. Buchanan

gers. Prior to his new assignment, Mr. Buchanan was sales manager for chemicals, metals, and plating products for the company, which he joined in 1947 as a chemical engineer.

Mr. Buchanan received a B.S. in Chemical Engineering from Rensselaer Polytechnic Institute, and the M.S. degree in Industrial Management from Massachusetts Institute of Technology on a Sloan Fellowship.

He is a member of Society of the Plastics Industry, Society of Plastics Engineers, American Electroplaters' Society, American Chemical Society, and the Chemists' Club.

Pittsburgh Plate Glass Co. Establishes New Dept.

Pittsburgh Plate Glass Co.'s paint division has announced the establishment of a new commercial development department. The principal functions of this department will include market research and development of new products. The new department will have as an overall objective the future growth of the division.

Dr. Elmer C. Larsen has been appointed to the position of director of commercial development and will report to the divisional vice president. Prior to joining the company in this new position, Dr. Larsen was associated with the J. T. Baker Chem. Co., where he served as vice president and technical director and as a member of the board of directors.

He has degrees from St. Olaf's College, Montana School of Mines, Stuttgart Institute of Technology in Germany, and University of Wisconsin. He served with Bell Telephone Laboratories and Sylvania Electric Products before joining Baker Chemical.

R. J. McComb Associates Appointed by Pressure Blast

Pressure Blast Mfg. Co., Inc., Manchester, Conn., announced that *R. J. McComb Associates*, Shelton, Conn., have been appointed sales representatives for the company's line of pressure blast units and abrasives. They will cover a sales territory encompassing three states — Connecticut, Metropolitan New York and northern New Jersey.

R. J. McComb Associates for many years, have been active in the metal finishing field and sales of chemicals, barrel finishing and degreasing equipment for the trade. The firm is comprised of five representatives; they are: *R. J. McComb, Joseph Bizzarro, Louis Venditto, Anthony Jarossi* and *Frank Shute.*

Bee Chemical Establishes East Coast Headquarters

Bee Chem. Co. of Chicago, Ill. announces the establishment of new East Coast sales headquarters at 119 Ann St., Hartford 3, Conn. Concurrently, it was reported that *L. A. Dickinson* was promoted to the position of managing the operation. Mr. Dickinson was formerly located at the main office of the firm in Chicago, where he devoted several years in both laboratory and sales work on coatings for automotive, appliance, and vacuum metalizing applications. Telephone at the new location is CHapel 9-7691.

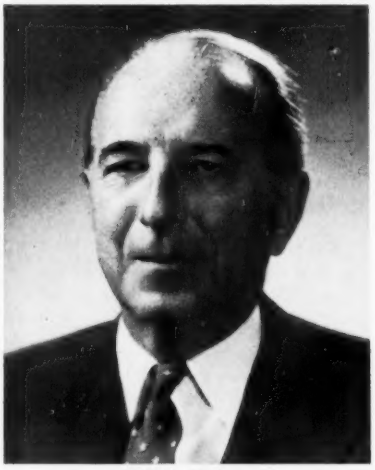
Changes at Rinshed-Mason

Larry M. Furlan, industrial finishes sales-engineer for *Rinshed-Mason Co., Inc.*, has been assigned to the company's northwest and central Ohio sales territory. Prior to this appointment, he had been assistant to *Robert C. Aiken*, industrial sales manager.

It was further reported that *John C. Eastland* has joined the firm as industrial finishes sales engineer. He has established himself in Atlanta, Ga., to serve the northern half of this state. Eastland has more than 20 years of industrial finishes experience.

Changes at the McGean Chemical Co.

Several changes in the management of *The McGean Chemical Co.* have been announced by *Ralph L. McGean*, who has been elected president. He succeeds the late *John A. McGean*, who



Ralph L. McGean

Paul M. Savage

Robert H. Louden

Dickson L. Whitney

was an associate of John D. Rockefeller and who also served as president of Harshaw-Fuller and Goodwin Co., forerunner of Harshaw Chemical Co., before founding McGean Chemical in 1929. Mr. McGean has been vice president and general manager of the firm since its founding.

Paul M. Savage, who has been a director as well as secretary, and in general charge of sales since the company's founding, has been elected vice president. He is a graduate of Case Institute of Technology and a trustee of the college.

Dickson L. Whitney, who has been with the company for seven years, will continue to serve as a director and as treasurer.

Robert H. Louden, who has been with the company for 20 years, has been elected secretary. He will assume the position of sales manager, assisted by Mr. Whitney. *Harry J. Beckemeyer*, who previously taught ceramic engineering at Iowa State College for 12 years and served as senior research engineer for the Universal Rundle Corp., has joined the firm. Dr. Beckemeyer will be in charge of ceramic sales.

Mitchell-Bate Moves

Mitchell-Bate Co., expanding their activities throughout the east, have moved to new and larger quarters at 1040 So. Main St., Waterbury 6, Conn. The telephone number is PLaza 4-5181.

Wisconsin Protective Coating Co. Appoints Representatives

Wisconsin Protective Coating Co., Green Bay, Wis., announces the appointment of new direct factory representatives in various areas of the country as follows: *Allegheny Tool Co.*, 3201 Smallman St., Pittsburgh 1, Pa. to cover western Pennsylvania, the counties west of and including Potter, Clinton, Centre, Cambria and Bedford; *R. J. Swanson Co.*, 6272 W. North Ave., Chicago 39, Ill. to cover the northwest three counties of Indiana, northern Illinois and counties of Iowa bordering the Mississippi River; *Thomas J. Reese Co.*, 2127-20th St., Cuyahoga Falls, Ohio to cover the counties in northern Ohio north of and including the counties of Paulding, Putnam, Hancock, Wyandotte, Crawford, Richland, Ashland, Holmes, Tuscarawas, Carroll and Columbia.

S. & S. Chemical Moves

S. & S. Chemical Co. announces that it has moved to new and larger quarters at 5770 N.W. 36th Ave., Miami 47, Fla. The telephone number is NE 4-9779.

Macarr in New Location

All manufacturing and servicing of *Macarr, Inc.*, are now moved to 4360 Bullard Ave., Bronx 66, N.Y., telephone FA 5-5510.

The increased space and improved facilities are designed to give high quality, advanced design equipment and faster deliveries, to all their existing and prospective customers.

Sel-Rex Establishes European Division in Geneva

The establishment of a European Division in Geneva, Switzerland, with complete facilities for manufacturing and marketing their precious metals plating processes and equipment, has been announced by *Sel-Rex Corp.*, Nutley, N. J. Managed by newly-named vice president *Rene J. Rochat*, the European Division has the responsibility of coordinating the activities of an extensive distributors' network covering major industrial centers in Asia, as well as Europe.

Swiss-born René Rochat comes to the company with nearly 15 years' uninterrupted experience in the precious metals electroplating field. A graduate Chemical Engineer of the University of Geneva, he was formerly manager

Rene Rochat

of one of the largest gold refining and precious metal plating operations in Europe.

Bill Zwerner, also an alumnus of the University of Geneva, in Electrical Engineering, has been named manager of manufacturing for the European operations. Mr. Zwerner has had extensive experience in the design and installation of electroplating facilities. He is reported to have engineered the installation of some of the largest precious metals electroplating operations in Europe.

In addition to supplying a focal point for marketing activities, the new division is equipped to perform analysis of solutions and electrodeposits, and to do sample plating with the various precious metals processes.

Bill Zwerner

Block Resigns from Richardson-Allen

Wesley S. Block, Jr., former president of the *Richardson Allen Corp.*, has announced his resignation as chairman and member of the board of directors.

Mr. Block will devote his time to *Wesley Block & Co., Inc.*, 300 Northern Blvd., Great Neck, N. Y. This organization, of which Richardson Allen Corp. was a manufacturing affiliate, he established in 1930.

Trinz Heads Vulcanium Corp.

James K. Trinz has been appointed president of *Vulcanium Corp.*, manufacturers of titanium racks and corrosion resistant equipment for the metal finishing industry. Mr. Trinz announced establishment of a new plant at 3080 Skokie Valley Highway, Highland Park, Ill.

A familiar figure in anodizing and electropolishing circles, Mr. Trinz has specialized in the engineering and development of high capacity, high production racking systems of both standard and custom design. He indicated

that the company would begin immediate marketing of several new types of low cost adjustable racks.

Weaver Appointed by Stokes

William James Weaver has been appointed product specialist in high vacuum pumps, pumping systems, gauges, valves, and other components by *F. J. Stokes Corp.*, Philadelphia.

Mr. Weaver, a native of Flemington, N. J., received his B.S. in mechanical engineering from Lafayette College. After serving with the U. S. Army as a member of the guided-missile anti-aircraft artillery school, Fort Bliss, Texas, he joined Air Products, Inc., Allentown, Pa., in 1954, working on sales of the company's low-temperature process equipment. In 1958 he became sales manager of International Pump Co., Livingston, N. J.

Du Pont Appoints Parker

Arthur H. Parker has been appointed technical representative for *Du Pont* sodium products in the Detroit area, the company has announced. Mr. Parker goes to Detroit from Wilmington, where he was chemist at the sales technical laboratory of the company's Electrochemicals Department. Since joining Du Pont in 1947, he has been engaged in technical work concentrated in the metal treating field.

CORRECTION

Our apologies to Messrs. *Fortin* and *Vandeveer*, for transposing their pictures in our August issue.

Ben P. Fortin

Wellington Vandeveer

Wellington Vandeveer is the new president of *Circo Equipment Co.*; and *Ben P. Fortin*, formerly assigned to Tyler, Tex. for *Oakite Products, Inc.*, has joined the staff in Los Angeles, Calif.

Blakeslee Opens New Shipping Points

G. S. Blakeslee & Co., Chicago, Ill., recently added two new drumming and distribution centers for their Blacosolv

trichlorethylene degreasing solvent at San Pedro, Calif., and Carteret, N. J. The California shipping point will serve West Coast locations. The Carteret plant will ship to eastern Massachusetts, Connecticut, Rhode Island, southeastern New York, New Jersey, eastern Pennsylvania and eastern Maryland.

Scheduled to handle truckloads and carloads in drums, as well as bulk shipments, the new terminals mean reduced shipping time and faster service on truckload and carload orders across the country, say company officials. Two other shipping points, at Wyandotte, Mich., and Niagara Falls, N. Y., are also serving the other customer locations.

Carborundum Co. Announces Promotions

Major organizational changes in research and development activities at *The Carborundum Co.* have resulted in three promotions in the Research and Development Division, according to an announcement.

Donald G. Sturges, formerly manager of the New Products Development Branch was promoted to associate director of the division. *Frederick J. Ross, Jr.*, formerly manager of the Ceramic Fiber Project, was promoted to manager of the New Products Development Branch to succeed Mr. Sturges. *Dr. Wingate A. Lambertson* was promoted from assistant to the manager to the position of assistant manager of the Engineering Research Branch.

Mr. Sturges, as associate director of research and development, will have direct supervision of the Central Laboratory in Niagara Falls which encompasses basic research, engineering research, and new products development.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Metropolitan Regional

The New York and Newark branches announce that they will hold one joint annual metropolitan regional educational session every year. The New York branch will be the host at the first such meeting, to be held on Friday, September 25, 1959, at 8:00 p.m. at the Hotel Hilton-Statler in New York City.

Speakers for the evening are *A. Mendizza*, corrosion engineer at Bell Telephone Laboratories, who will speak on "Plated Coatings for Electrical Contacts"; and *Dr. Edward W. Saubestre*, technical director at Enthone, Inc., whose topic will be "Metal Cleaning."

A social hour will follow the meeting, during which refreshments will be served.

Buffalo Branch

The branch will hold its first meeting of the 1959-60 season Friday, Sept. 11, at the Niagara Manor, Buffalo, N. Y.

The technical session will feature a talk by *G. A. Lux* of Oakite Products, Inc. The subject will be "Some Fundamentals of Metal Cleaning" and will include: 1) the factors that enter into the selection of a metal cleaner, 2) the

requirements of a modern metal cleaner and 3) some suggestions for the efficient use of metal cleaners.

Plans for the new season and reports on the Golden Jubilee Convention will be covered in the business session and will be of utmost importance to all Buffalo members.

The October and November meetings will be held the first Friday of the month. Time, place and speakers to be announced later.

Robert E. Lienert
Secretary

SPE REGIONAL TECHNICAL CONFERENCE

PLASTICS FINISHING

Recognizing that plastics finishing and decorating is involved in a vast percentage of all molded plastics items, the Buffalo Section of the Society of Plastics Engineers in cooperation with the SPE Professional Activity Group — Plastics Finishing, has scheduled a technical meeting covering this important phase of the industry.

This RETEC will be held October 16, 1959 at the Hotel Niagara, Niagara Falls, New York. It will encompass the more important methods by means of which this operation can best be accomplished.

Program Chairman *Gordon K. Storin* has announced the following schedule of papers:

Finishing and Decorating of Plastics Materials by: a.) Silk Screening; b.) Printing; c.) Spray Masking — *Arthur Skeels, Sr.*, Art Decorating Co.

New Developments in Coatings and Vacuum Metalizing Systems for Plastics — *T. E. Hayden*, Bee Chem. Co.

Hot Leaf Stamping — *Martin A. Olsen*, Olsenmark Corp.

Mechanical Finishing of Plastics Using Coated Abrasives — *Ronald Reid*, Carborundum Co.

At the conclusion of the last paper there will be an open discussion period at which all four speakers will take part. Questions from the floor are invited.

A prominent speaker will also be scheduled for the Conference luncheon.

For further information, write *Gordon K. Storin*, 3 Forest Rd., Lewiston Heights, Lewiston, N. Y.

UPPER MIDWEST METAL FINISHING ASSOCIATION

The Twin City Branch announces it's leaving the American Electroplaters' Society and forming a new group which will be known as the *Upper Midwest Metal Finishing Association.*

The new association is comprised of over 90 persons actively engaged in the science of metal finishing in the area comprising Western Wisconsin, Northern Iowa, North and South Dakota and the State of Minnesota. The new group will continue to have its monthly meetings on the first Monday of each month from October through June, with the meetings held at Jax Cafe, 20th & University Ave., Northeast Minneapolis. The meetings will be held, as in the past, beginning at 7:00 p.m. on the evening of the meetings for a dinner followed by a technical session.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS

Two papers related to corrosion mitigation are included in the NACE

Northeast Region Corrosion Conference to be held October 5-8 at the Lord Baltimore Hotel in Baltimore, Md.

A paper "Chromium Electroplates for Corrosion Protection of Stressed Type 410 Stainless Steel in High Temperature High Purity Water" by *Henry Suss*, Knoll's Atomic Power Laboratory, Schenectady, N. Y., describes variations in results obtained with the use of chromium plate for the protection of hardened and stress relieved type 410 stainless steel against stress corrosion cracking on exposure to 300°F. water.

C. Tirrel, Ionics, Inc., Cambridge, Mass. will present a paper on "Properties and Applications of Platinum Surfaced Anodes."

The electrodes are composed of films of platinum 20 to 50 micro-inches on titanium or tantalum valve metal. Platinum coated anodes have the electrochemical properties of platinum and can be made easily with the physical properties demanded by the application.

Thirty-five technical papers will be presented in eight symposia. Further information may be obtained from *Kenneth M. Huston*, Conference Co-Chairman, 3208 Tyndale Ave., Baltimore 14, Md.

SOCIETY OF VACUUM COATERS

The third annual meeting will be held on January 26 and 27, 1960 at the Hotel Biltmore in New York City.

On Tuesday, January 26th, the registration desk will be open from 12:30 p.m. to 5:00 p.m. There will be an executive committee meeting from 10:00 a.m. till noon, other committee meetings from 1:00 to 3:00 p.m., and the business meeting will be held from 3:00 to 5:00 p.m.

A tentative program of technical papers has been scheduled for Wednesday, January 27th. These will include such topics as, "Thick Films," "Equipment Design for Maintaining Dust Free Conditions," "Filaments, Firing Techniques and Some Causes of Discoloration of Metalized Coatings," "Safety Factors for Handling Flammable Materials," etc. There will also be a new equipment symposium.

Additional information may be obtained by contacting *John H. Smith*, Technical Service Department, Consolidated Electrodynamics Corp., 1775 Mt. Read Blvd., Rochester 3, N. Y.

FEDERATION OF PAINT AND VARNISH PRODUCTION CLUBS

All the exhibit space for the Paint Industries' Show for 1959 has been assigned. It will be held in the Lower Hall of the Atlantic City Convention Hall from October 20-24. Some one hundred six exhibitors will occupy more than twenty-thousand square feet of exhibit area, making this year's show the largest ever presented.

Federation members and visitors will see technical and engineering advances in the industries supplying materials and equipment to the paint, varnish, lacquer, printing ink, and allied industries. New products, new knowledge relating to existing products and their uses or, in some cases, existing knowledge which is not generally available to the consuming industries will be featured. New equipment and new applications of existing equipment will also be demonstrated.

News from California

By Fred A. Herr

Milton Weiner, chemical engineer of Whittier, Calif., reports that he moved his laboratory and classroom facilities, effective August 1, from 671 West Putnam Drive, Whittier, to larger quarters at 12631 East Imperial Highway, Santa Fe Springs, Calif.

Weiner announced that he is offering two training courses in electroplating, chemistry and electrochemistry this fall. Training Program A is to begin Sept. 21 and will be conducted in 12 classes held every Monday from 7:15 to 9:45 p.m., from Sept. 21 through Dec. 7.

Subjects will include the following: handling of chemicals, preparing solutions, purification, sacrificial metals, decorative chromium, hard chromium; preparation of aluminum, sulphuric acid anodizing, tin, brass, bronze, and electroless nickel, precious metal plating, metallurgy, specifications, and shop equipment analysis.

Course B will cover theoretical chemistry and electrochemistry and their applications to plating. Subjects to be discussed will include solutions, atomic theory, electron theory, ionization theory, Faraday's laws, electromotive series, polarization, corrosion, and plating variables.

A jarring explosion which ripped through the chemical plant of the Pilot California Co. in Santa Fe Springs, Calif., recently killed one workman, severely injured three others, and caused damage estimated at $25,000. Ten firemen suffered foot burns. The blast came from a boiler when a tank of chemicals overflowed on hot metal.

A paper on plating of wire and wire products was presented at the West Coast Regional Meeting of The Wire Association at the Fairmont Hotel, San Francisco, recently by *Donald Stewart* of the Industrial Hard Chrome Co., Oakland, Calif.

The conference program consisted of one day of technical discussion and an all-day tour of one of San Francisco's major wire production and processing plants. Papers were also presented by *J. L. Humphreys*, Bethlehem-Pacific Co., Los Angeles, on nut and bolt specifications; *Richard T. Merrill, E. F. Frederick* and *G. R. Decker* of Columbia-Geneva Steel Co. on heat treating of steel wire; *L. J. Welsh*, Oakland, on storage and shipping of wire; and *Ward Dobbins*, Simmons So., San Francisco, on spring wire.

Chromalloy Corp., of Los Angeles reports acquisition of the Chromizing Corp., same city. The latter began operations in 1952 as a licensee of Chromalloy and has specialized in the processing, development, and production of metal coatings and alloys.

Shifts in California area personnel of Oakite Products have been announced as follows:

J. G. Hickey, who has worked out of

the San Francisco office since 1954, has been transferred to the Sacramento, Calif., branch. *Ben P. Fortin* has been transferred from Tyler, Tex., to the Los Angeles staff, with *Henry L. Jones* succeeding Fortin in Tyler.

John C. H. Pauls died July 16 at Glendale Sanitarium, Glendale, Calif., aged 71. For 50 years Mr. Pauls served as an industrial engineer with the National Lead Company. The widow, one daughter and three sons survive him.

The University of California at Los Angeles collaborated with the Los Angeles Paint & Varnish Production Club in presenting a two-day Coatings Conference at UCLA Aug. 31 and Sept. 1.

The program was prepared in collaboration with *Edward Campbell*, the club's educational chairman, his committee members, and representatives of the university. The conference covered polymers, instrumentation, film formation, color, corrosion, and microbiology. The conference agenda was focused on new ideas, knowledge and original research. Local as well as mid-western and east coast representatives of the industry appeared on the program.

Manufacturers' Literature

Chemical Deburring Solution

MacDermid Inc., Dept. MF, Waterbury, Conn.

Metex ZD Burr 3, a chemical deburring solution for Zamak 3 diecastings that cuts immersion time, speeds bulk handling and thus greatly reduces labor costs, is fully described in Technical Data Sheet No. 91, a two-page usage and instruction sheet.

Pumps

Detroit Harvester Co., Dept. MF, 21800 Greenfield Road, Oak Park 37, Mich.

Centrifugal and rotary pumps for a wide range of industrial uses are described and illustrated in a 72-page, two-color catalog just issued.

The catalog covers pumps designed for special conditions of temperature, viscosity, specific gravity, lubricating characteristics, chemical properties, contaminants and abrasives. Also included are descriptions and specifications of pump parts and accessories.

Sandblast Nozzles

Diamonite Products Mfg. Co., Dept. MF, Shreve, Ohio.

Features of the new Double L sandblast nozzles are graphically described in a two-color brochure recently published. The four-page bulletin emphasizes the superiority of the new nozzles in concentrating and accurately controlling the flow of abrasive materials. It also illustrates on the job uses of the nozzles.

Liquid Buffing Compositions

Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

Bulletin LIQ-600, a 16 page manual on automatic liquid spray buffing, contains data on set-up and operating procedures for automatic buffing, burring and polishing. Information includes material on recommended abrasive

grades, drawings of typical layouts and a section on recommended equipment.

Buffs and Polishing Wheels

Schaffner Mfg. Co., Inc., Dept. MF, Schaffner Center, Pittsburgh 2, Pa.

This catalog pictures, and fully describes, twenty-five wheels, their construction and recommended use. It is punched for insertion in binders.

Metal Buffing

American Buff Co., Dept. MF, 2414 S. La Salle St., Chicago 16, Ill.

The series of comments on buffing and on general subjects by *Ben P. Sax*, which has appeared in the above company's advertisements, has now been reprinted in a little booklet for free distribution.

Standardized Rectifiers

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

Three bulletins describe and illustrate a new general industrial rectifier line and new plating and anodizing lines.

The bulletins: ER-111, ER-200, and ER-300, are designed to help answer such questions as: What kind of rectifiers are available? What kind of rectifiers should you buy? What kind of controls should you order? What kind of protective systems are offered?

Rubber-Bonded Abrasives

Carborundum Co., Dept. MF, Niagara Falls, N. Y.

Rubber-bonded abrasives for polishing and finishing, such as rubber-bonded polishing wheels, unfinished sticks and stones, special purpose stones, and wheel dressers and sticks, are featured in a new folder.

Their special function and types of materials on which they are particularly useful, specifications and prices are clearly and concisely set forth.

Ultrasonic Cleaning

Circo Ultrasonic Corp., Dept. MF, 51 Terminal Ave., Clark, N. J.

A newly published 12-page booklet, entitled, "Tips on Ultrasonic Cleaning," includes a simplified explanation of the basic principles, a brief description of the generating equipment and transducers required, a discussion of proven applications, and a list of seventeen of the most frequently asked questions about ultrasonics, with appropriate answers.

Rust Preventive

MacDermid Inc., Dept. MF, Waterbury, Conn.

Metex Rust Retardant M-610, a clear, dark brown, viscous oil which is self-emulsifying to give a creamy emulsion is fully described in Technical Data Sheet No. 93, a two-page usage and instruction sheet.

Metal Cleaning

Equipment Div., Magnus Chemical Co., Inc., Department MF, Garwood, N. J.

A new metal cleaning handbook presents over one hundred types of equipment and techniques for the cleaning and preparation of metal surfaces.

The new 32-page handbook covers both the basic factors in metal cleaning and specific methods to meet a variety of cleaning problems, includ-

ing degreasing, decarbonizing, washing, stripping, drying, blackening, phosphating, rustproofing, pickling, and coating.

Various sections cover the analyzing of cleaning problems and the subsequent selection of the correct chemical method and equipment for the individual job.

Handling & Power Equipment

Syntron Co., Dept. MF, 732 Lexington Ave., Homer City, Pa.

A new condensed catalog 596, of materials handling equipment, parts handling equipment, power rectification equipment, mechanical shaft seals, and portable power tools is announced by the above manufacturer.

The 68 page catalog presents descriptions, data and specifications, and is illustrated to show products and products in operation.

Metal Cleaners

Northwest Chemical Co., Dept. MF, 9310 Roselawn, Detroit 4, Mich.

A four page brochure is available on the above firm's immersion, electrolytic and spray cleaners, as well as acid addition agents, strippers and drawing compounds. A list of representatives across the nation is also given.

Finishing Processes

MacDermid Inc., Dept. MF, Waterbury, Conn.

A pocket-size reference summary of metal finishing literature gives valuable where-to-use information, makeup, operating instructions, analysis and control for a wide variety of cleaners, copper-plating processes, dry acid salts, Macromate coatings and many other specialties. This summary folder lists data sheets by number, trade name and use.

Platinum-Group Metal Products

Metals & Controls Div., Texas Instruments, Inc., Dept. MF, 34 Forest St., Attleboro, Mass.

A new eight-page general brochure briefly describes platinum-metal products including solid and clad platinum metals and alloys in sheet, strip, wire, foil and seamless tubing; parts, shapes and specialties; dental foil, electrical contacts, electrodes, gauze, catalysts, salts and derivatives, expanded anodes, laboratory ware, rhodium plating solutions, transistor materials and thermocouple wire. Services offered are smelting, residue preparation, sampling, assays, refining, and chemical analysis.

Ultrasonic Cleaning

Acoustica Associates, Inc., Dept. MF, Fairchild Court, Plainview, N. Y.

An applications bulletin on the technique for cleaning miniature differentials ultrasonically describes how assembled units, designed for use in precision electromechanical equipment, can be completely cleaned in less than one minute without disassembly.

Masking Tapes

By-Buk Co., Dept. MF, 4314 W. Pico Blvd., Los Angeles 19, Calif.

Masking tape discs in sizes from 1/8 inch in diameter up, discs made from special tape for anodized surfaces, heavy cardboard discs for flush mask-

ing, taper and self-threading plugs, very narrow masking tape as small as 1/32" wide are among the many masking aids illustrated and for which convenient dimension specifications are provided in Brochure M-24.

Media Storage Bins and Pans

Techline Div., Wheelabrator Corp., Dept. MF, 1150 Avenue V, Vicksburg, Mich.

New bins and pans designed for the convenient storage and handling of all barrel finishing media are described in Bulletin No. 401.

Included in the two-page bulletin are complete specifications, line drawings and illustrations. The bulletin also employs brief explanations to outline how the installations of the bins and pans can save time and labor in the finishing department operation.

Maintenance Coatings

Carboline Co., Dept. MF, 32 Hanley Industrial Court, Brentwood 17, Mo.

A new four page chart, No. 5, is designed to aid all engineers and maintenance personnel concerned with buying and specifying corrosion resistant maintenance protective coatings.

The chart compares 17 standard systems, showing the strong and weak points of each. Accurate resistance ratings are listed for acid, alkali, solvent, water, weathering, flexibility, impact and abrasion, and temperature conditions. Compatibility over old paint, surface preparation and general comments are included.

Steam Specialties

American Air Filter Co., Inc., Dept. MF, 215 Central Ave., Louisville 8, Ky.

Bulletin 203 discusses and illustrates a line of valves, float and thermostatic traps, steam traps, and pipe line strainers.

Dimensions, capacities, patterns, weights and accessories are highlighted, and outstanding features of the valves, floats and traps, their construction and operation are fully explained.

Air Heaters

Hartzell Propeller Fan Co., Dept. MF, Piqua, Ohio.

A new series of gas-fired intake units for supplying tempered make-up air to replace air removed by industrial exhaust systems is described in Bulletin A-115.

Automatic Viscosity Control

Pneuma-Flo Systems Inc., Dept. MF, 141 W. 20th St., New York 11, N. Y.

Automatic viscosity control is described in new 6-page illustrated bulletin, including handy demonstration request form. This brochure describes how this equipment maintains viscosities of industrial finishes at any setting, by automatic solvent addition.

Abrasive Blast Barrels

Pangborn Corp., Dept. MF, Hagerstown, Md.

Bulletin No. 705 describes the complete line of heavy-duty Rotoblast barrels.

A detailed description along with drawings and photographs is also given of the T-section extra-heavy work conveyor and the new push-button door. A planning chart gives overall dimen-

sions, door opening, abrasive flow and exhaust air volume required.

Duct Fans

Hartzell Propeller Fan Co., Dept. MF, Piqua, Ohio.

A new line of belt-drive duct fans with adjustable driver sheaves which permit quick easy adjustment of fan speed is featured in Bulletin A-114A

Process Drying

Advance Process Supply Co., Inc., Dept. MF, 2315 W. Huron St., Chicago 12, Ill.

A twelve page illustrated brochure, No. 2059, discusses process drying through automation with the Auto-Jet Turbo-Dryer. Its advantages, and drying area and conveyor belt width specifications are listed, as well as engineering data.

Selective Plating

Sifco Metachemical, Inc., Dept. MF, 935 E. 63rd St., Cleveland 3, Ohio.

A 4-page illustrated brochure describes the Dalic process of electroplating selected areas without using immersion tanks.

Viscosity Control

Norcross Corp., Dept. MF, 247 Newtonville Ave., Newton 58, Mass.

Bulletin No. V-1224 describes viscosity control equipment for automatically adding solvent to correct for evaporation losses. Indicating-controlling and recording-controlling systems are covered.

Coated Valves

Rockwell Mfg. Co., Meter and Valve Div., Dept. MF, 400 N. Lexington Ave., Pittsburgh 8, Pa.

An 8-page, photo-illustrated bulletin, V-614, describes special coated lubricated plug valves. Descriptions of the coating properties, valves available, tables of recommended applications and photo-illustrations showing typical installations are included in the new bulletin.

Finishing Cost Guide

Apollo Metal Works, Dept. MF, 366 Place & S. Oak Park Ave., Chicago 38, Ill.

Metal Parts Finishing Cost Guide is especially designed for determining and comparing costs involved in metals finishing procedures: (1) on premises finishing of parts; (2) off premises finishing of parts, and (3) use of prefinished metals.

The guide is a 25½ x 11-inch folder containing simple, easy-to-follow instructions and outlines for each of the three metal finishing procedures. Adequate space is provided for filling in and extending the various costs.

Cyclone Separators

Torit Mfg. Co., Dept. MF, Walnut and Exchange Sts., St. Paul, Minn.

Literature shows how one or a combination of 8 cyclone separators can protect machinery investment, product quality, employee health and reduce maintenance costs with fully effective dust control in a wide range of applications.

The information sheets also include multiple rating tables, complete specifications and a dimensional drawing.

Protective Coatings

Horsey, Robson & Co., Inc., Dept. MF, 551 Fifth Ave., New York 17, N. Y.

A four-page brochure introducing the complete line of Horsey-Set products is illustrated with photographs of various applications of the different coatings.

The brochure includes test data detailing impact and abrasion resistance, thermal conductivity, shrinkage, moisture absorption, adhesion and other important facets. Also included is information on resistance to various chemicals.

Cable Conveyors

The E. W. Buschman Co., Dept. MF, Cincinnati 32, Ohio.

Bulletin 40A illustrates and describes the above firm's cable conveyor installations for the various industries —metalworking, woodworking, auto and aircraft, etc.

Titanium Fact File

Mallory-Sharon Metals Corp., Dept. MF, Niles, O.

A new, 24-page "Fact File" on titanium and titanium alloys contains sections on high temperature performance, corrosion resistance, erosion resistance, titanium properties, metallurgy, machining, fabrication, welding, testing, along with a list of the alloys and mill shapes available.

Dust Collectors

Torit Mfg. Co., Dept. MF, Walnut & Exchange Sts., St. Paul, Minn.

New data and information on 99-plus per cent dust control with cabinet cloth filter dust collectors is now available from the above manufacturer. The information sheets include multiple rating tables, complete specifications, and a dimensional drawing.

Paint Spray Equipment

Binks Mfg. Co., Dept. MF, 3122 Carroll Ave., Chicago, Ill.

This detailed, concise 8-page bulletin describes the three steps necessary before making a selection of equipment for a specific job. The first step is determining whether the job is protecting the surface or improving its appearance (maintenance or finish spraying). The second step is determining the size of the job—small, medium or large. Finally the spray painter determines whether the equipment is to be used occasionally or regularly.

With these three questions answered the spray painter can turn to the charts and quickly select the correct equipment from compressor to material handling pumps to spray gun with recommended nozzle sizes for different compressors.

Finishes for Aluminum

Reynolds Metals Co., Dept. MF, Box 2346, Richmond 18, Va.

This new 28-page handbook brings together the most advanced data obtainable on preparation and treatment of aluminum surfaces. Starting with cleaning treatments, the booklet explains theory and method for five major types of finishing operations, mechanical, chemical, anodic, organic, and porcelain enamel, including their advantages, disadvantages and costs. Its aim is to provide information needed to select the best finish for a particular application.

Acid-Proof Cements

Atlas Mineral Prod. Co., Dept. MF, Mertzstown, Penna.

Bulletin #5-2, recently revised and updated, fully describes acid proof cements and their various recommended applications. This bulletin also contains a resistance characteristics chart for reference.

Corrosion Resistant Undercoat

Northwest Chemical Co., Dept. MF, 9310 Roselawn, Detroit 4, Mich.

The above firm announces its four page bulletin on Interlox, a pre-paint treatment for steel. Its advantages and uses are listed, as well as a description of each product for iron phosphating.

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Udylite automatic processing machine, used for dichromating, can be converted to zinc easily, 36' total length. First offer of $4500.00 takes this machine. Address: September 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

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SALES REPRESENTATIVE

SITUATIONS OPEN—Expanding Northeastern Company, well established in the metal finishing trade, needs forward looking representatives to handle full line of metal cleaners and specialties, anodes, and allied chemicals. Several territories open and relocation may not be required. Salary and commission commensurate with sales and technical background. Our men know of this advertisement. Address: September 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

EASTERN PENNSYLVANIA TECHNICAL SALES REPRESENTATIVE

SITUATION OPEN—Leading eastern manufacturer of cleaning, burnishing, deburring, aluminum treating and related compounds, with distributorship of complete line of plating equipment and supplies offers excellent opportunity to ambitious young man. Thorough knowledge of metal finishing operations required: selling experience not essential. Liberal commissions and benefits. Send complete resume. Address: August 6, care Metal Finishing, 381 Broadway, Westwood, N. J.

TECHNICAL SALES & SERVICE

SITUATION OPEN—In Midwest for man, preferably experienced, in calling on job and captive electroplating plants for one of the world's leading companies. Please write giving full resume of experience, age and marital status. Our fieldmen know of this advertisement. Address: May 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATING ENGINEER

SITUATION OPEN—Leading national manufacturer of electronic wiring devices has an opening for a graduate engineer with a BS in chemistry or chemical engineering. He should have 5 to 8 years of experience in the plating field. This would be production work specializing in gold, silver, nickel, and tin plating, involving experimentation and development of new plating methods. Send resume to AMP Inc., 2100 Paxton St., Harrisburg, Pa.

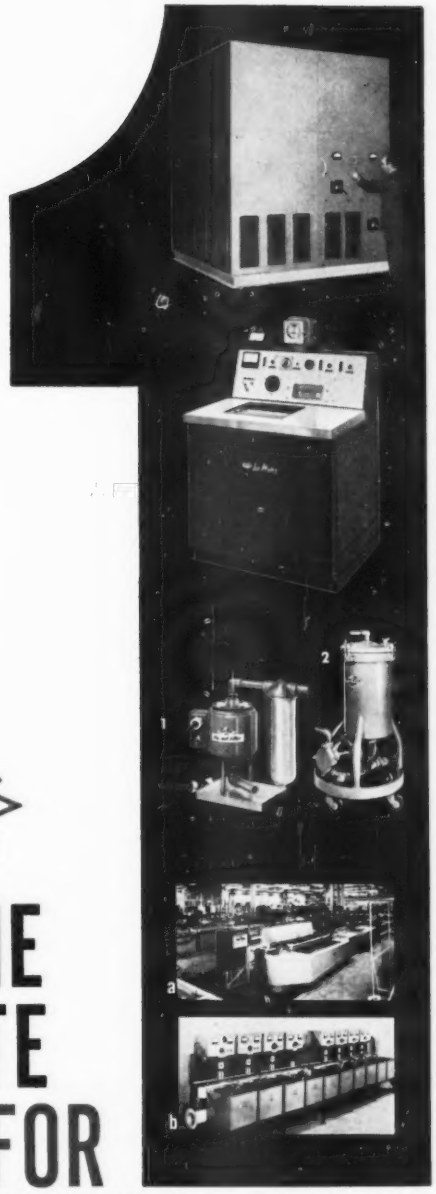
ENGINEER OR CHEMIST FOR TECHNICAL SERVICE

SITUATION OPEN—Knowledge of electroplating, anodizing or related metal finishing desired. Moderate travel. Salary commensurate with training and experience. Good benefit plans. Location Syracuse, New York. Please send resume in confidence giving age, education, experience and approximate salary to Central Personnel Office, Solvay Process Division, Allied Chemical Corporation, P. O. Box 271, Syracuse 1, New York.

ELECTROPLATING ENGINEER

SITUATION WANTED—Engineer with 16 years of diversified experience in metal finishing seeks position in metropolitan New York area. Analytical control, procedure planning and testing of all plating and anodizing processes, including precious metals. Familiar with technical service and equipment design alike. Address: September 5, care Metal Finishing, 381 Broadway, Westwood, N. J.

SUPPLIERS OF EQUIPMENT AND MATERIALS AND ADVERTISERS INDEX



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This special news bulletin, "FROM THE REPORTS", goes out once a month to every MacDermid man. It's filled with valuable metal finishing hints, unusual application stories, new and exciting and different case histories—all gathered from the men out in the field.

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